The Chemical Age

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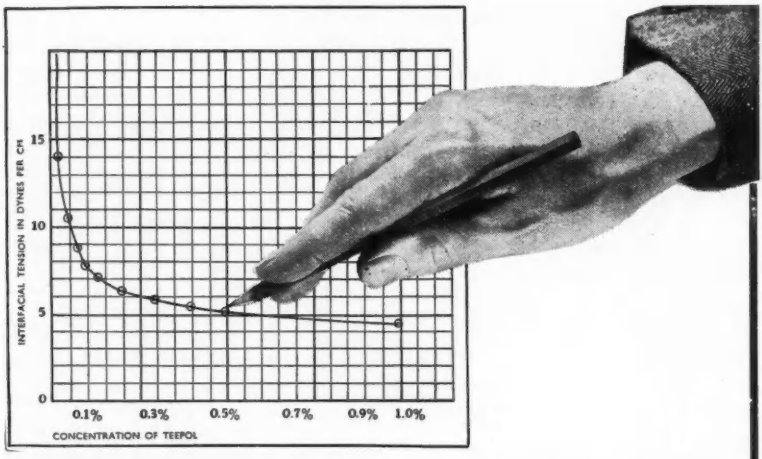


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The
# Chemical Age

*The Weekly Journal of Chemical Engineering and Industrial Chemistry*

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## Neglected Lime Producers

THE use of lime in husbandry is said to be older than Christianity. Much of our farming lore is associated with crisp generalisations about the white and the black manures—lime and animal dung. But the very antiquity and familiarity of lime has probably deprived it of some of its significance in an age which seems slightly bemused by the great new fields which synthesis techniques have uncovered. The abundance of limestone deposits in this country and the relative cheapness of lime—whether as burnt lime, hydrated lime, or ground limestone itself—has made it something of a Cinderella to farmers and chemists alike. The proof of that can be seen in the fact that our soils generally were so acidic that in 1937, under the Land Fertility Scheme, began the generous subsidy payment to encourage farmers to apply lime. These subsidies to-day amount to about half the cost of lime and its spreading and, while feeding stuffs and fertilisers are being bereft of subsidies, there is no sign of a change in policy towards the older subsidies for lime. Yet it is clear from a recent survey that the tonnage of lime applied to our soils is still alarmingly below minimum technical requirements.

In 1941 it was estimated that our arable and grassland acreage, excluding rough grazing land, required 15½ million tons of lime (as calcium oxide). This was not an annual requirement but an overall quantity needed to bring these soils to a *p*H favourable to efficient food production. Had it been possible to apply all this lime in one or two years there would still have been need for an annual maintenance tonnage to balance the steady losses of lime which result inevitably from leaching and crop uptake. Between 1937 and 1949, under the Land Fertility Scheme, some 16 million tons of lime have been applied. A new estimate has been made to see how much this twelve-year effort has reduced the overall or intrinsic requirement. According to a report in the current *National Agricultural Advisory Service's Quarterly Review* (1950, *8*, 183-184) the overall requirement still stands at 14 million tons of lime. In short, most of the 16 million tons applied from 1937-1949 have only balanced losses; possibly some 1½ million tons has in addition reduced the initial degree of acidity in the soils of England and Wales. The problem is still huge and of a much greater significance, now that we have a far more intensified agriculture than we had in the 'thirties.

# On Other Pages



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It is no exaggeration that chemical industry as a whole has been content to neglect lime and lime-containing materials except insofar as they are required for chemical processes. Lime is generally looked upon less as a valuable chemical substance than as a material worthy of attention only when it can be cheaply handled mechanically. Its low cost and its familiar abundance have placed lime low in the chemical list. If to-day farmers were to take a full advantage of the subsidies and start buying on a really substantial scale it is doubtful if the tonnage of agricultural lime required could be produced.

The ancient process of burning limestone in kilns to produce lime itself has been handicapped by fuel shortage and rising fuel costs, and it is now well established that this operation is not warranted for the production of agricultural material. Ground limestone is at least as efficient as burnt lime, although roughly twice the amount per acre must be applied; for equivalent alkalinity, limestone reduces soil acidity quite as effectively as burnt lime. Many farmers, unfortunately, have yet to accept this modern concept of liming and the full utilisation of limestone deposits is held back by the "burnt lime" doctrine of both producers and consumers. Meanwhile, in terms of ground limstone, the overall requirement of our soils is 28 million tons, i.e., twice the estimated lime requirement, and the annual maintenance amount is probably 3 to 3½ million tons. Here, surely, is an opportunity for the most fruitful collaboration between the Ministry of Agriculture, chemical industry and farmers. The raw material does not have to be imported; most workable deposits are in country areas, or certainly outside the congested industrial centres, so that an expanded production of ground limestone should not have to face serious labour shortages.

The present comparative neglect of lime and limestone can be traced in a large measure to the fact that, from their inception, the subsidies have aimed solely at encouraging the farmer to use more lime; there has been no direct incentive to potential producers to make available more lime or limestone. There is evidence that some limestone quarries find the agricultural trade less profitable than the building trade. The fact that every farm bill for lime must be scrutinised by the Ministry responsible for paying the farmer the 50 per cent subsidy has led to an indirect and implied system of low and controlled prices per ton. A subsidy which was intended to

(*continued on page* 182)

# Notes and Comments

## Mercurial Lead Prices

THE laconic announcements by the Ministry of Supply that lead has undergone another price increase of so many pounds per ton have, by repetition, acquired such familiarity that to many they must seem "just another administrative adjustment." The considerably more serious import of lead charges five or six times as large as the pre-war figure (£123 last year and £96 per ton now) to those who must have the metal or its oxides to maintain export business has been pointedly presented by Mr. H. S. Tasker, chairman of Goodlass Wall & Lead Industries. The mercurial character of lead prices since the beginning of last year has posed for lead users problems more appropriate to professional backers of racehorses. Most of the responsibility for that rests upon the widely fluctuating American market by which English prices are broadly regulated. That is perhaps unavoidable under bulk buying. What is avoidable—and inexcusable in the light of the Government's enthusiasm for competitive pricing in the export markets—is the tendency of the Ministry of Supply to act as an astute monopolist maintaining lead prices above the figure ruling in other markets. This means of augmenting the vast sums of which the Government now disposes is even more objectionable than the company profits tax.

## Themes for Section B

THE panel which selected from the multiplicity of "possibles" the chemistry subjects to be presented before the famous Section B of the British Association meeting in Birmingham at the end of this month must be endowed with uncommon self restraint to have resisted so well the temptation to admit a dozen fascinating themes. The selectors for the chemistry section have confined the scope broadly to four themes—carbohydrates, which Professor E. L. Hirst, F.R.S., will introduce in his presidential address; contemporary ideas regarding the natural and synthetic polymers; the eminently topical subject of chromatography; and finally the widely differing manifestations of chemical energy and practical or potential methods of harnessing it. Even without the supplement of visits to some most advanced chemical works in the Birmingham area and the topical interest of some companion sections, such as the industrial possibilities of nuclear power and radioactive isotopes (Section A, Mathematics and Physics), Birmingham would be invested with exceptional attractiveness for Chemists from August 31 until September 6.

## Chemical Scope of Canada

CANADIAN chemical industries sometimes seem to exemplify collectively chemical development in its most promising form, armed with the most advanced technology and a growing storehouse of material in its crops, minerals and petroleum. Most Canadians would readily accept that proposition and could quote half a dozen good reasons why Canada's rôle as producer of foodstuffs and buyer of chemicals and other highly evolved products of outside industries—normally those of Great Britain and the U.S.A.—has now nearly been played out. The knowledge that in June this year Canada bought from this country chemicals of various kinds worth £263,000, twice as much as in any June in the previous two years, probably does not invalidate the confidence that has grown out of the initial development of the great petroleum reserves located in Alberta and the relatively rapid creation of new production capacity as advanced as anything to be found below the U.S. border. All those factors have been taken into account in the latest survey of Canada's chemical future, an admirably well balanced review by Mr. Arnold H. Smith (the Monsanto

Chemical Co. (Canada), Ltd.) to the Canadian Society of Chemical Industry, of which he is president. "Of all the present industrial countries Canada seems to be in the number two position for overall raw material supplies needed by the chemical industries," is one of his conclusions. Resulting from the new awareness of the wealth contained in her abundant coal, oil, gas, timber and water power, production of actual chemicals alone rose 11 per cent, to $150 million between 1948 and 1949. Growing support is likely to be found for the proposition that Canada should now protect these precious growths, having in mind the formidable U.S. tariff wall and our own Key Industry Duties.

## A Refractory Subject

THE presentation by radio of chemistry and similar scientific themes in their relationship to everyday life seems to have established a successful tradition here. An indication of the possible extent of developments of the principle of talking to ordinary individuals about industrial and scientific affairs which they might be expected to regard with complete indifference can be seen in recent experiments in the U.S.A., where public enlightenment in esoteric affairs is an older established practice. An extreme example recently in the department of industry was a Pittsburgh broadcast, of which the local group of the American Chemical Society was the sponsor, telling America how great a debt it owed to refractory materials in the provision of the sort of things which modern society cannot dispense with. "Refractories and You" was in the form of an interview with Mr. S. M. Phelps, senior fellow of the refractories fellowship at the Mellon Institute, Pittsburgh, who gave an effective picture of the dependence of a host of common things, tableware, glass, cement, sanitary fittings and so on, upon materials which will resist great heat in the furnace stage of manufacture. As a result, many in the orbit of the Pittsburgh broadcast must now have a fairly clear conception of the sort of work which chemists have to do to make available large tonnages of materials which will resist 1500° C., abrasion by flue dust and furnace charge and the corrosion of slag and incandescent gases. Whether or not that knowledge promotes heightened respect for the chemist, it cannot fail to impart a more balanced view of his part in the general scheme.

## An ICI Works to Close

THE I.C.I. tube mill at Witton, Birmingham, is to discontinue operations at the end of this year and the work will be split between the company's new £3 million plant now in course of construction at Kirkby, Liverpool, and other I.C.I. Midlands plants. News of the change, due to reorganisation, had given rise to unfounded rumours that other of the group's tube-making establishments in the Midlands were to close and their operations transferred to Liverpool. A statement was issued from Witton, by Mr. H. E. Jackson, chairman of the I.C.I. Metals Division, discounting this.

Mr. Jackson said the reason for the building of the Liverpool factory, and its equipment with the latest machinery, was because they could not expand the premises in Manchester, where they were subject to flooding. It was hoped to find work in other of the firm's Birmingham factories for the men affected by the change.

### NEGLECTED LIME PRODUCERS

(*continued from page* 180)

encourage lime consumption in the national interest of land fertility has in effect discouraged production. There is now obvious need of some means of giving producers confidence that the agricultural lime trade can be reasonably profitable.

It is an unhappy paradox that at a time when so vast a quantity of lime is known to be vitally needed by our soils there are once-vigorous limestone quarries either idle or producing much less than their real capacity. There is plenty of limestone in the country; it requires only to be quarried, pulverised and spread over the soils that so badly need it.

## BRITISH CARBON BLACK

### *Anglo-U.S. Plant Opened at Stanlow*

THE importance of carbon black among the country's key raw materials was stressed by Mr. Harold Wilson, President of the Board of Trade, last week when he opened the Cabot Carbon plant at Stanlow, Ellesmere Port, Cheshire.

Despite initial problems of expense (THE CHEMICAL AGE, *59*, 811), the plant, planned by Americans and created by English workmanship, has been completed in little over a year. The factory is the first to be constructed under the Marshall aid investment guarantee.

Nearly the whole of Britain's carbon black has previously been imported from the U.S.A., but it is estimated that the new plant will produce 8-10,000 tons a year at a saving of about $1 million annually. All black smoke will be eliminated by a scrubbing process and there will be no lowering of Merseyside's atmospheric standards.

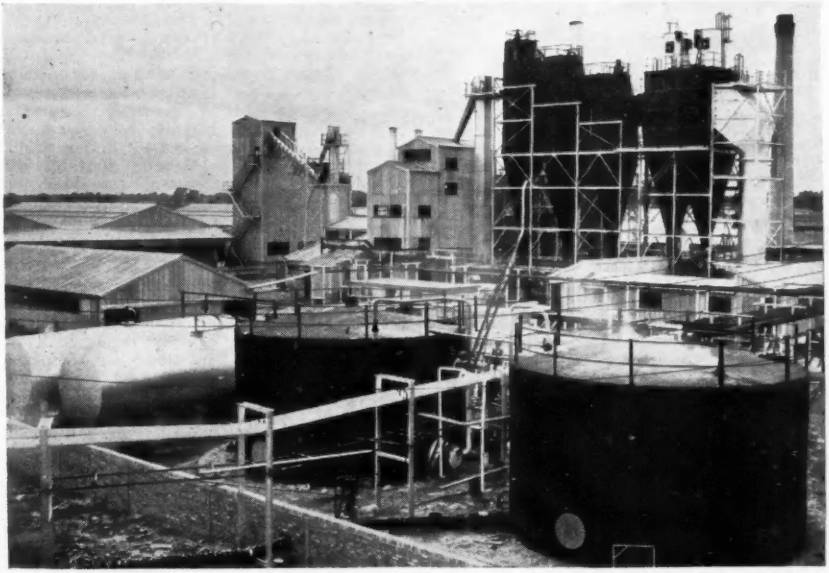
Mr. Louis Cabot, managing director of Cabot Carbon, Ltd., said that the company intended to play its part in Britain's industrial recovery.

## SOAPLESS DETERGENTS

### *Laundry Group Uses No Soap*

SYNTHETIC detergents have taken the place of soap in all the laundries of the United Co-operative Laundries Association, Ltd., which has plants at Liverpool, Birkenhead, Manchester, Warrington, etc. This concern has an annual trading turnover of £1 million. Mr. T. Lowe, the general manager, stated at the annual staff conference that the use of soap for the group's laundry processes had been stopped entirely. That decision was based on research and experiment, the results of which had been made available to the industry which he hoped would carry the work still further.

Group manager Mr. J. C. Hogg said soap used to cost UCLA £24,000 per annum. The synthetic materials used instead cost £13,750 for the same volume of work. There was a considerable saving in fuel and in water consumption. Soap, he added, has done a good job in the past and was still doing so for those laundries which can afford it. If synthetic detergents cost the same as soap they would still be the first choice of enlightened laundries.



*The new carbon black plant, showing the furnace and fuel storage installations and the large cyclone precipitators*

## CHEMICAL IMPORTS: £17.3 m.

### *Record for First Half of the Year*

IMPORTS of chemicals, drugs, dyes and colours in June totalled £2,855,164 which was £644,038 more than the same month of 1949, but was £372,817 less than the figure recorded in May—£3,227,981. Decreases occurred in sodium and potassium compounds, and even more markedly in the value of gas and chemical machinery imported. These were offset, however, by marked increases in some items, notably carbon blacks and sulphur.

Total value of imports in chemicals, drugs, dyes and colours for the first six months of this year was £17,353,156 compared with £13,456,734 in the first half of 1949 and £15,519,551 in 1948.

| | June, 1950 | June, 1949 |
|---|---|---|
| | Cwt. | Cwt. |
| Acetic anhydride ... ... | 7,852 | 9,845 |
| Acetic acid ... ... ... | — | 5,744 |
| Boric acid ... ... ... ... | 9,640 | 11,440 |
| Carbolic acid ... ... ... | 5,360 | — |
| **Value of all other sorts of acid ...** | **£90,843** | **£33,910** |
| | Cwt. | Cwt. |
| Borax ... ... ... ... | 26,803 | 18,200 |
| Calcium carbide ... ... ... | — | — |
| Cobalt oxides ... ... ... | 268 | — |
| | Tons | Tons |
| Fertilisers ... ... ... ... | — | 123 |
| | Lb. | Lb. |
| Glycol ethers and gylcol esters ... | 483,463 | 605,220 |
| Iodine ... ... ... ... | — | 66,050 |
| | Cwt. | Cwt. |
| Potassium chloride ... ... | 628,021 | 1,021,250 |
| Potassium sulphate ... ... | 18,460 | 12,100 |
| All other potassium compounds ... | 17,902 | 3,166 |
| **Value of all potassium compounds** | **£556,444** | **£819,766** |
| | Cwt. | Cwt. |
| Sodium nitrate ... ... ... | — | 81,093 |
| All other sodium compounds ... | 11,590 | 2,283 |
| **Value of all sodium compounds ...** | **£78,231** | **£85,092** |
| Dyes and dyestuffs: | Cwt. | Cwt. |
| Synthetic organic dyestuffs ... | 1,110 | 994 |
| Extracts for dyeing ... ... | 2,532 | 994 |
| Extracts for tanning (solid or liquid) ... ... ... | 128,219 | 85,115 |
| All other dyes and dyestuffs ... | 513 | 227 |
| Pigments and extenders: | | |
| Earth colours (except black) ... | 19,618 | 93,927 |
| Carbon blacks from natural gas | 72,326 | 10,410 |
| **Value of carbon blacks ... ...** | **£303,304** | **£30,635** |
| **Value of chemicals, drugs, dyes and colours ... ... ...** | **£2,855,164** | **£2,161,626** |
| | Lb. | Lb. |
| Essential oils (other than turpentine ... ... ... ... | 468,052 | 256,340 |
| **Value of essential oils ... ...** | **£349,856** | **£174,413** |
| **Value of oils, fats and resins** | **£12,986,002** | **£8,996,011** |
| | Tons | Tons |
| Sulphur ... ... ... ... | 48,224 | 34,423 |
| **Value ... ... ... ... ...** | **£490,438** | **£282,204** |
| | Cwt. | Cwt. |
| Gas and chemical machinery ... | 116 | 14,924 |
| **Value ... ... ... ... ...** | **£3,885** | **£203,215** |
| | Cwt. | Cwt. |
| Plastic materials ... ... ... | 16,910 | 14,463 |
| **Value ... ... ... ... ...** | **£391,672** | **£355,030** |

### Service Awards

Gold watches have been presented to 210 Fort Dunlop workers for long service.

## BENZENE AND TOLUENE

### *Advantages of the Catarole Process*

A NOTE from Petrochemicals, Ltd., gives useful information about Catarex benzene, one of the many products of the Catarole process, essentially the catalytic thermal decomposition of a light petroleum distillate to give olefines and aromatics. From the aromatic products bulk quantities of Catarex benzene, of a purity not usually encountered in industry, are now being produced at Partington, near Manchester.

The specification for this benzene stipulates a thiophene content of less than 25 p.p.m. and a total sulphur content of less than 0.005 per cent. Very low thiophene and total sulphur contents may be particularly important in catalytic processes (such as the hydrogenation of benzene to cyclohexane), as they ensure relative freedom from catalyst poisoning.

Because of its high purity, the use of Catarex benzene in synthetic reactions, either as reactant or solvent, minimises the formation of undesirable intermediate products. That advantage is already manifest in the production of dyestuffs, pharmaceuticals and other materials.

For processes which require benzenes of even higher purity, two grades, Catarex benzene TF and Catarex reagent benzene are also being manufactured.

Of almost equal importance is the new Catarex toluene now being produced in bulk from the aromatic products at Partington. It has the same low total sulphur content and lacks foreign odour and colour. This toluene contains no di-olefines, and consequently it does not deteriorate in colour when stored.

## Toxic Chemicals Panel

A WORKING party to study precautionary measures against the toxic effect of chemicals used in agriculture has been appointed by the Minister of Agriculture and Fisheries. The terms of reference require the panel to advise on the recommendations on this subject made in the report of the Gowers Committee on health, safety, and welfare in non-industrial employment. The working party will be constituted as follows:—

Professor S. Zuckerman (chairman), Mr. A. B. Bartlett, Mr. R. A. E. Galley, Mr. C. T. Gimingham, Mr. A. Holness, Mr W. Morley Davies, Mr. R. G. C. Nisbet, Mr. J. M. Rogan and Mr. H. Cole Tinsley; joint secretaries, Mr. K. R. Allen and Mr. J. T. Martin.

# PHARMACEUTICAL INDUSTRY IN WAR

## *Limited Initiative Displayed in Germany*

THE conclusion that German pharmaceutical industry did not advance during the war years at a rate at all comparable with its British counterpart is one of the more interesting conclusions reached in a final survey of the data collected by the various Allied investigation teams when the war ended. "The Pharmaceutical Industry in Germany during the period 1939-45" (BIOS Survey No. 24), which Dr. J. B. M. Coppock, director of the British Baking Industries Research Association, has edited, gives the first overall view of the efficiency and general scope of the industry and provides many specific examples in support of the general views. The falling away from the technical and commercial eminence reached by German groups before the war is a process capable of being rapidly reversed, as Dr. Coppock recognises. Underlining this, the editor says in his preface: "If this review does little more than remind British industry of the need to maintain the advantage and prestige it gained during the war years it will have served its purpose."

### Lost Impetus

The report as a whole justifies the general conclusion that German investigation of medicinals, which in several directions was partial and inconclusive, fell on evil days during the supreme control of the Nazis for the waging of war. There was nothing, it would appear, to equal the discovery by the Bayer laboratories of I. G. Farbenindustrie in the 1920's of the antimalarials plasmoquine and atebrin. After the loss of North Africa, the less evident need for really effective quinine substitutes further weakened the effort of the small group in the Bayer laboratories to which the work seems to have been confined. The Germans are considered to have been satisfied with a relatively much lower standard of efficiency of synthetic antimalarial drugs.

Another instance of lack of enterprise on an equivalent scale is represented by what the report records about German policy in regard to antibiotics: "Their knowledge and experience were very limited." The Germans had not secured a satisfactory strain of *Penicillium notatum*. The culture media were of the conventional Czapek-Dox type and the use of corn steep liquor does not appear to have been known. Potencies claimed for the solid product were 50-150 units/mg. No work on streptomcyin had been done.

The backwardness in this instance is considered to have been attributable in part to the belief that antibiotics could not develop into a serious competitor of the sulphonamides.

### Incomplete

There is evidence in other sections of the report of much more enterprising policy in relation to bulk production, more especially of such things as analgesics. There are repeated evidences, however, that technical developments to secure the highest quality of product were not always carried to their normal culmination.

The chapters are liberally annotated for reference to the original longer BIOS, FIAT, etc., reports.

The chapters, each contributed by an authority, including the editor, cover broadly these departments of German pharmaceutical industry:—

1. Amino acids and protein hydrolysates;
2. Antibiotics;
3. Anticoagulants;
4. Antimalarials;
5. Antiseptics;
6. Arsenicals (organic);
7. Analgesics, anaesthetics, antipyretics and spasmolytics;
8. Barbiturates;
9. Blood preparations;
10. Cholagogues;
11. Diuretics;
12. Extracts;
13. Glycosides;
14. Insulin;
15. Insecticides and rodenticides;
16. Laxatives;
17. Oestrogen and sex hormones;
18. Pharmaceutical preparations;
19. Plant hormones;
20. Sulphonamides;
21. Sweetening agents;
22. Tuberculocides;
23. Vitamins.

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### New Indian Drugs for Skin Diseases

Two new drugs from the medicinal neem tree have been evolved at the Indian Council Scientific Research Laboratory. Tests are said to have shown that these drugs, Nimbidin and an allied compound sodium nimbidinate, can be effective in the treatment of skin diseases such as eczema, septic sores, etc. They can also be applied as a gargle for sore throats.

## U.S. INDUSTRIAL PROJECTS

### *Antibiotics, Detergents and Metals*

THE National Distillers' Chemical Corporation, which in June began producing metallic sodium in its new $10 million plant at Ashtabula, Ohio, has devised new techniques for sodium dispersions that are claimed to make it easier to control sodium reactions in the sodium user's own plant for either laboratory or full-scale operations, and substantially to accelerate the reaction rate. Reaction temperatures can, it is stated, be lowered with corresponding increase in yield. These sodium dispersions, it is pointed out, make possible new reactions which formerly were limited by decomposition at the temperature required to obtain a suitable rate. They can be handled at room temperature. The metallic sodium is dispersed in inert media that boil at temperatures higher than the melting point of sodium and contain up to 50 per cent by weight of sodium metal. The dispersions are made in suitably modified colloid mills. Sodium is dispersed in such inert media as toluene, xylene, naphtha, kerosene, white oil, petroleum jelly, naphthalene or paraffin. Particle sizes ranging from submicron to 20 microns, with an average of 2 to 3 microns, are said to be easily obtainable.

* * *

The chemical furfural, produced from farm wastes, is now being used by Eaton Laboratories, Ltd., of Norwich, New York, to develop a new group of furane drugs, including a germicide, a fungicide and an anti-histamine drug. U.S. scientists believe it may possibly prove to be the starting point for a new range of chemicals, comparable to benzene, on which much of the modern drug, dye and plastics industries are based. The germicide made from furfural, Furacin, is being considered as a synthetic antibiotic in the class of penicillin, and it is claimed that its kills some germs that penicillin does not.

* * *

Production of lauryl sulphate detergent is to be started soon by U.S. Industrial Chemicals, Inc., in a new plant in Baltimore, Maryland. The new liquid detergent, Sipon L-20, is the first surface active agent to be marketed by this company as the result of the programme undertaken jointly by the American company and Société Sinnova, of Paris. The detergent is particularly recommended for use where high foam and detergency and mild action on the skin are desired.

## LIFE-SAVING CHEMICALS

### *BMA President's Review*

ADDRESSING the 18th annual meeting of the British Medical Association recently, Sir Henry Cohen spoke of the reduction of mortality in the course of certain diseases which some of the new drugs had made possible. In his address following his election as president of the BMA, Sir Henry said: "As an example of the benefits which recent therapeutic advances bring to the individual patient rather than the community, let me quote first the effects of sulphonamides in pneumonia. Flippin *et al.* reported in 1943 that of 1906 cases of pneumonia treated before sulphonamides were introduced the mortality was 40.1 per cent; of 1635 cases treated after the introduction of sulphonamides only 10.6 per cent died.

"In another series recorded by Ungeleider and his colleagues in the same year the pneumonia mortality rate for 1935 to 1937 before sulphonamides were used in treatment was 20.8 per cent. In 1938 the case mortality was 79 per 100,000. In the period 1938 to 1942 the case mortality had been reduced by the use of sulphonamides to 3.9 per cent, which represented for 1942 a death rate of 32 per 100,000. Thus in the United States alone 25,000 lives had been saved yearly by the sulphonamide drugs, and the reduction in the length of illness resulting from treatment had added at least a million days to the working capacity of the nation.

#### Sulphonamides in Meningitis

"In the American Civil War the death rate from meningococcal meningitis was estimated at about 90 per cent; towards the latter part of the first world war, when antimeningococcal serum became generally available, the mortality was reduced to about 30 per cent; in the second world war treatment with sulphonamides reduced the mortality to under 3 per cent.

"The triumphs of penicillin and other antibiotics have been too recent in the memory to justify repetition, and as yet only the fringe of their potential usefulness appears to have been reached. If an example need be chosen to illustrate the benefits of chemotherapy, few would be more informative than that of puerperal sepsis. Before the sulphonamide era the puerperal sepsis crude death rate was 154 per million; in 1939, when sulphonamides were in general use, this dropped to 63; in 1947, when penicillin was readily available, the rate had fallen to 16—a decrease of 90 per cent in less than 15 years."

# A NEW FLOW VALVE

## *Original Use of Liquid Pressure Principles*

A NEW flow valve of very original design was the subject of demonstrations for the information of the technical Press at research laboratories at Redhill Aerodrome, Surrey, on July 27. The organisers, Tiltman Langley Laboratories, Ltd., have produced specimen valves but do not propose to manufacture them commercially. The object is to design such valves, suitably modified, for any specific industrial purposes.

The valve is a compact and completely glandless unit which can be remotely controlled by pneumatic, hydraulic or electrical means. The valve offers low resistance at all rates of flow and pressures and it can operate at high pressures and at swift flow speeds.

Its small cross-sectional size enables the valve to be installed in a pipe run without requiring special clearances between adjacent pipes, and the "straight-through" flow avoids pipe bends or constrictions.

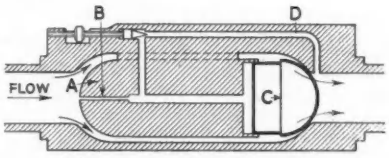
Because the valve is glandless, there is no risk of fire when inflammable liquids are handled; since the valve can be fabricated from any material—even glass or carbon—there is no danger of corrosive liquids attacking the valve components or leaking from it. Acids, alkalis, steam and gas flows may be handled with safety.

The valve lends itself to easy remote control. Without power services, remote control can be obtained up to 15 ft. merely by utilising the fluid flow pressure. Electrically operated, the valve will control flows of 30 g.p.m. at pressures up to 500 p.s.i., using only 0.33 amp from a 24 V supply.

### Possible Applications

There appear to be many possible applications for the valve: for handling corrosive materials; for remote control of water or gas supplies; fire sprinkler systems—using the valve operated from fusible plugs to supply water immediately at high pressures. This does not, of course, exhaust the range of possible uses.

In the accompanying diagram, showing the valve in its basic form, it will be seen that the chamber houses a central component A, supported by three radial webs. The body is spherically shaped at the input end and has a supply hole B drilled through it centrally. This connects with




*Tiltman Langley flow valve*

a piston chamber at the outlet end of the central component, in which moves a piston C, which is spherically ended and shaped like a mushroom.

Connecting the upstream end of the piston to the outlet of the valve is a by-pass D. When the by-pass is closed, the pressure built up against the piston is greater than the flow pressure acting on the downstream end. The piston therefore moves to close the main flow and seats against the outlet wall of the valve body. The piston is held here because the load on the piston is greater than the load over the resisting area round the spherical end of the piston. The difference of pressure is the measure of effective sealing.

Opening the by-pass will relieve the load on the piston, the pressure being dissipated through the by-pass more quickly than the build-up achieved through the supply hole B, which is deliberately throttled to obtain this effect. The load on the piston face therefore becomes less than that at the spherical end and the piston moves back, opening the flow passage to the main fluid flow. The higher the main flow pressure, the quicker will the valve open.

By adjusting the throttle B, the rate of operation can be controlled. Throttling B, for example, will prevent hammer in the valve.

## Glass Tubing Cutter

A SIMPLE glass tubing cutter for the laboratory and workshop is among the latest additions to equipment provided by Griffin and Tatlock, Ltd. The cutter, made of aluminium alloy, has a base shaped to hold tubing in a vee under the cutting wheel. Six rustproof steel cutting wheels are kept inside the hollow cutting arm. Another new item described in leaflets just issued by the company is the G & T Modulat electrically heated oven for drying, incubating or sterilising.

# USING THE CONSULTANT

## *Functions of an Inadequately Defined Service*

by a CONSULTANT CHEMIST

ONE dictionary defines a consultant as "one who consults." If this is true, then the independent consultant might, more properly, be called a consultee, because he is the person actually consulted. However, "A rose by any other name would smell as sweet" and it is not our intention to dogmatise on minor details of terminology.

What is it that prompts a person to seek the services of a consultant? In many cases it is because an executive finds the burden of his responsibilities too great for him and he wishes to have them eased, in part, at any rate. There are, moreover, certain times when it is politic for the executive to be able to say that he has taken independent and expert advice on some special topic. Consultants undertake a considerable amount of arbitration work, varying from a relatively simple piece of analytical chemistry to decide the correct amount payable for a consignment of merchandise, to the resolution of major problems, requiring decision and opinion.

There is also the equally important duty of acting as an expert witness whose evidence in court can help the judiciary in ensuring that not only is justice done, but that it appears to be done.

The above are, principally, short-term problems, but there is the other side of the picture to be considered; for example, the design of large and extensive installations. This usually involves intensive research and far-sighted planning, and the consultant may need a large staff to aid his handling of such a task.

### Multifarious Advice

Because a consultant may be called upon to give advice on plant design, erection and maintenance; medical and legal matters; research and development; marketing; safety; and a host of other things, it is not surprising that there are so many different types of consulting practices. There is hardly a single branch of industry or commerce in which the services of a variety of consultants are not in regular use.

The first essential for a consultant is that he should have a broad outlook, not a parochial one. He is expected to be absolutely independent, impartial and unbiased in everything he may say or do. The consultant should, of course, have a high sense of professional integrity and sufficient skill and experience to gain and keep the confidence of his clients.

Much has been said, and will no doubt continue to be said, about the apparent uselessness of some consultant service. This aspersion usually arises because the client has not told the consultant the whole story, possibly having left him to grope, as it were, in complete or semi-darkness by withholding some essential detail about the background of the problem.

### Data Withheld

There is a case on record of a chemist having been invited to ascertain the cause of some uneven dyeing, who was not allowed to make any inspection of the dyehouse. This left him in the invidious position of being able to report only that there was more dyestuff on the deeper coloured parts than on the paler. He was thus, through no fault of his own, unable to find out the true cause. The uneven dyeing was, in fact, due to a fault in a hydro-extractor.

Another case has been quoted in which an expert was invited to examine the methods used for the manufacture of a non-chemical product, involving a number of stages. After much detailed study, including a considerable amount of experimental work, he was able to report only that, in his opinion, no alterations were necessary, neither could he suggest any means which would significantly improve the quality of the finished product. A report of this nature was regarded by the clients as very unsatisfactory because it had been costly, and they had derived nothing from it. Such a difficult position could perhaps have been eased by the consultant, before undertaking the task, by indicating that the client might only have, as the result of the consultant's work, the satisfaction of knowing that his plant was efficient and his product as good as contemporary knowledge could make it.

How should one set about obtaining the services of a consultant? As a professional man, the normal channels of public advertisement are not generally used by consultants here, although there is certainly nothing undignified or unprofes-

sional in some small panel advertisements which in the U.S.A. regularly appear in *Industrial and Engineering Chemistry*. These announcements, all appearing together in one place, give a prospective client very useful guidance in his choice. A number of professional bodies keep lists of members who are independent consultants. Such information is readily available from the Royal Institute of Chemistry and the Institution of Chemical Engineers. The journals serving chemical industry also have a considerable acquaintance among consultants and are generally very willing to make that knowledge available to those who need it. In chemical consultancy there is fortunately no artificial barrier to prohibit a direct approach between consultant and client, comparable to that which complicates securing specialist advice in medicine or the law. The chemical manufacturer who has decided to pay the piper can usually discuss the tune without resort to an intermediary. That system has the considerable merit of minimising the total cost.

## Fees

The fee paid a consultant is generally a mutual arrangement between the parties, and depends on the extent of the work involved and the degree of skill required to carry it out. It may parallel the legal basis of a fee and a "refresher" when this becomes necessary. It is usual for the fee to be paid at the end of the work but in the case of a long inquiry it may be more convenient to arrange for an account to be submitted periodically.

Should the client wish to have the sole call on the consultant's services for a period, then the consultant will clearly be entitled to a retainer. This retainer can in no sense be regarded as being in lieu of fees. Its purpose is to compensate the consultant for any loss of profit he sustains while he is precluded from serving some other firm. The terms of the retaining fee will, of course, indicate the directions in which the activities of the consultant may be restricted.

In the design and erection of large plants, the fees are usually based on the cost of the work, with an appropriate minimum. Such a fee is usually paid in a limited number of instalments, as the work proceeds. The Association of Consulting Engineers has detailed a scale of fees considered suitable for the above type of work, with specimen forms of agreement covering the work done and the arrangements for payment.

One model form of agreement recommended by the association stipulates that the consultant's fee shall be calculated on the actual cost of the work, and for intermediate payments the amount should be calculated upon the best cost estimate available at the time. This schedule provides two categories, undertakings costing less than £75,000 and those costing more than £75,000.

In the first category the payment to the consultant would be:—

| | |
|---|---|
| On the first £2500 ... ... ... | 10 per cent |
| On the next £7500 ... ... ... | 8½ ,, |
| ,, ,, £25,000 ... ... ... | 7 ,, |
| On all further cost ... ... ... | 6½ ,, |
| OVER £75,000 | |
| On the first £75,000 ... ... ... | 7 ,, |
| On the next £125,000 ... ... | 6 ,, |
| ,, ,, £300,000 ... ... | 5 ,, |
| On all further cost ... ... ... | 4½ ,, |

So far, little has been said of the duties which the consultant owes to his clients. They are in principle very simple. He should regard his client's affairs as confidential to himself; he should do his best to serve the client's interests. He should be impartial and truthful, even though the advice he must offer may not be very welcome to the client.

The few more or less authoritative pronouncements relating to the ethics of consulting work all follow similar lines. The Royal Institute of Chemistry refers to this matter in its bye-laws and also in its charter. The American Institute of Chemical Engineers allows its code of ethics to be reprinted in full in Perry's "Chemical Engineers' Handbook." This code lays special stress on the confidential nature of the work and of the results obtained, and also the importance of upholding the dignity of the profession. The Association of Consulting Engineers binds its members to a very strict code which covers the relations not only between the consultant and his client, but between one consultant and another. Study of these documents clearly shows the high standard of professional conduct required of the consultant. One has every reason to believe that those consultants one knows abide by these codes of behaviour, and are anxious to ensure that members of the profession should be known for their integrity as well as their competence.

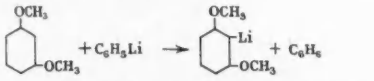
As a general rule, consultant service is of great value to smaller firms, the scope of whose activities is not sufficient to permit the maintenance of large research departments. In such instances, the consultant is frequently employed to guide and direct a small technical staff, whose limited experience renders the supervision by an expert valuable, if not indispensable.

# ORGANO-LITHIUM COMPOUNDS—II

## *Some Important Common Reactions*

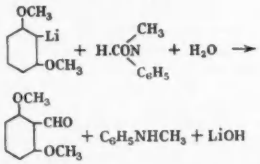
by R. W. MONCRIEFF

GRIGNARD reagents will not ordinarily replace hydrogen atoms that are bound to carbon atoms, but organo-lithium compounds will sometimes replace the hydrogen in a benzene nucleus. Thus resorcinol dimethyl ether forms 2,6-dimethoxyphenyl-lithium in 70 per cent yield even in the cold.



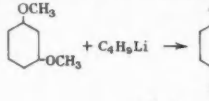
The replaceability of this nuclear hydrogen may seem surprising but it should be noted that it is made labile by the proximity of the two ether groups, whose polarity effects reinforce each other and tend to make the hydrogen labile. This may be illustrated :—

It is to be noted that lithium metal would not directly replace the hydrogen in resorcinol dimethyl ether; only when it is present as an organo-lithium compound, such as phenyl-lithium can it do this. Once the hydrogen atom has been replaced by the lithium from the phenyl-lithium the required group can be inserted. Reaction with, for example, N-methyl formanalide will give 2,6-dimethoxybenzaldehyde :—

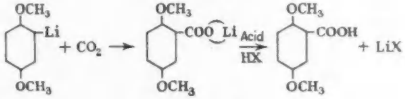


Gilman, Willis, Cook, Webb and Meals[4] have made 2-6 dimethoxybenzoic acid,

by a similar method; they reacted butyl-lithium with the dimethyl ether of resorcinol and then carbonated the lithium compound with solid carbon dioxide. The reactions may be written :—



and then



An example of a coupling reaction similar to the Wurtz-Fittig is to be found in the reaction of phenyl-lithium with benzyl bromide, which results in the formation of dibenzyl.

$$C_6H_5CH_2Br + C_6H_5Li \rightarrow C_6H_5CH_2Li + C_6H_5Br$$

$$C_6H_5CH_2Li + C_6H_5CH_2Br \rightarrow \underset{\text{Dibenzyl}}{C_6H_5CH_2CH_2C_6H_5} + LiBr$$

Whereas magnesium organo compounds will not add to an olefinic linkage, the corresponding lithium compounds will. Ziegler, Crössmann, Kleiner and Schäfer[7] showed that butyl-lithium would add on to 1,1-diphenylethylene

$$(C_6H_5)_2C{=}CH_2 + C_4H_9Li \rightarrow (C_6H_5)_2C(Li).CH_2C_4H_9$$

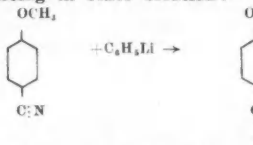
The lithium atom can then be replaced by hydrogen, alcohol, aldehyde, or carboxyl group.

Some carbonyl derivatives will not react with magnesium compounds because of steric hindrance, but will nevertheless react with organo-lithium compounds. One such case was reported (among others) by Wittig and Petri;[8] it is that of the naphthalene derivative

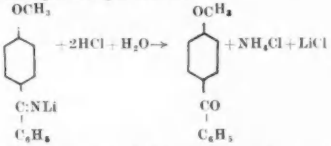
1-benzhydryl-8-naphthoic methyl ester, which reacts with phenyl-lithium, rapidly giving a good yield of the carbinol

1-benhydryl-8-(diphenyl-hydroxymethyl)-naphthalene.

The addition of methyl-lithium and phenyl-lithium to nitriles is also noteworthy. Gilman and Kirby[9] showed that they would give isolatable products. Thus anisonitrile reacts within phenyl-lithium, both being in ether solution:—



within 30 minutes and on treatment with acid, this gives an 85 per cent yield *p*-methoxybenzophenone:—



Similarly, methyl-lithium in ether solution gives with anisonitrile a 75 per cent yield of *p*-methoxyacetophenone. These reactions are particularly remarkable because anisonitrile (*p*-methoxybenzonitrile) will not react with Grignard reagents. Similarly *p*-dimethylaminobenzonitrile will not react with Grignard compounds, but does react readily with methyl-lithium or with phenyl-lithium.

### α-Alkenyl Lithium Derivatives

Braude, Coles and Timmons[10] quite recently reported the preparation of α-alkenyl lithium derivatives and their use in synthesising unsaturated compounds. Hitherto this class of reagents has been almost unknown, the only example that had been reported was styryl-lithium, which Wright[11] had stated to be formed no more easily than the magnesium derivative.

It is a limitation of the Grignard syntheses that alkenyl halides containing a halogen atom adjacent to an ethylenic bond can be converted to the organomagnesium compound only with difficulty. If, for example, vinyl bromide is treated with magnesium, it does not form a Grignard reagent, but instead loses the elements of hydrobromic acid to give acetylene, as was shown by Krestinsky[12]

$$2CH_2{:}CHBr + Mg \rightarrow 2CH{\vdots}CH + MgBr_2 + H_2$$

The only exceptions to this behaviour have been some of the aryl vinyl compounds such as β-bromostyrene, which Wright (*loc. cit.*) had found to react with aldehydes in the presence of magnesium to give in small yields some of the expected carbinols. In the main though, halogen atoms adjacent to ethylene bonds have been unable to pick up magnesium and form a Grignard reagent; this has sometimes excluded what would otherwise have appeared to be a simple and attractive synthesis.

Braude, Coles and Timmons have, however, found that the corresponding lithium derivatives can be obtained much more easily than the magnesium derivatives and have thus opened up a new synthetic route for the synthesis of ethylenic compounds, one that may be of considerable value. They found that highly purified isobutenyl bromide reacted readily with lithium metal in dry ether to give isobutenyl lithium:—

$$(CH_3)_2C{:}CHBr + 2Li \rightarrow (CH_3)_2C{\cdot}CHLi + LiBr$$

When the resulting solution was carbonated with solid $CO_2$ some of the organolithium compound which was formed reacted with the isobutenyl chloride to give dimethyl-hexadien:—

$$(CH_3)_2C{:}CHLi + (CH_3)_2C{:}CHBr \rightarrow (CH_3)_2C{:}CH{\cdot}CH{:}C(CH_3)_2 + LiBr$$

Dimethyl hexadien

and the remainder formed β:β-dimethyl acrylic acid:—

$$(CH_3)_2C{:}CHLi + CO_2 \rightarrow (CH_3)_2C{:}CHCOOLi \rightarrow (CH_3)_2C{:}CHCOOH$$

and also phorone by reaction of the carboxylate with a second molecule of isobutenyl-lithium:—

$$(CH_3)_2C{:}CHCOOLi + (CH_3)_2C{:}CHLi \rightarrow (CH_3)_2C{:}CHCOCH{:}C(CH_3)_2 + Li_2O$$

In this particular instance the yields of the three products were: 2:5-dimethyl hexa-2:4-diene, 35 per cent; β:β-dimethyl acrylic acid, 7 per cent; phorone, 15 per cent.

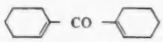
It will be noted that isobutenyl bromide $(CH_3)_2C{:}CHBr$ is a compound that cannot readily be dehydrobrominated, but the method just described can be used satisfactorily with other compounds whose formulæ suggest they could undergo dehydrobromination, but which when treated with lithium do not do so. Thus propenyl bromide

$CH_3CH{:}CHBr$ (β-methyl vinyl bromide)

apparently could easily lose the elements of hydrobromic acid, but it does not do so when treated with lithium in ether; instead propenyl-lithium $CH_3CH{:}CHLi$ is formed, together with a small proportion of propynyl-lithium $CH_3C{:}CLi$. Even the chlorides can sometimes be used instead of the bromides, *e.g.*, 1-chlorocyclohex-1-

enyl chloride, if treated with lithium and then with carbon dioxide, is converted into a mixture of cyclohex-1-ene-1-carboxylic acid,

and di(cyclohex-1-enyl) ketone



in an overall yield of 50 per cent.

The α-alkenyl lithium derivatives in general readily undergo the (usual Grignard) expected reactions with the following classes of compounds:—

1. Aldehydes and ketones to give ethylenic compounds, *e.g.*, (a) propenyl-lithium and benzaldehyde give the carbinol $CH_3CH:CHCH(OH)C_6H_5$ in 35 per cent yield.

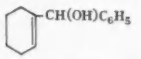
(b) isobutenyl-lithium and acetophenone yield the carbinol $(CH_3)_2C:CH.C(CH_3)(OH)C_6H_5$ in 33 per cent yield.

2. Carboxylic acid derivatives to give ethylenic ketones, *e.g.*,

(a) isobutenyl-lithium and lithium benzoate give isobutenyl phenyl ketone $(CH_3)_2C:CH.COC_6H_5$ in 40 per cent yield.

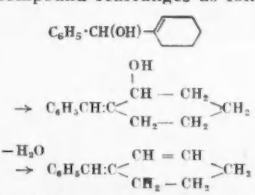
(b) isobutenyl-lithium and lithium acetate give isobutenyl methyl ketone, $(CH_3)_2C:CHCO.CH_3$ in 36 per cent yield.

It is clear that the existence of α-alkenyl-lithium compounds and the reactions they will undergo afford a new and valuable synthetic method for the preparation of ethylenic compounds. It is even more valuable because many of the unsaturated compounds that are obtained will undergo functional reactions and molecular rearrangements leading to other unsaturated systems. An example of this is afforded by the new compound:—



is made from cyclohex-1-enyl-lithium and benzaldehyde.

This compound rearranges as follows:—



Organo-lithium compounds have become one of the most useful synthetic aids. Similar in principle to the Grignard magnesium compounds, they will, owing to the much greater lability of the lithium atom, undergo rapidly many reactions that magnesium compounds make sluggishly and they will often react easily under conditions which permit no reaction with magnesium compounds. At the same time, the lithium atom is less reactive than sodium or potassium under similar conditions, so that whereas it is mostly impossible to isolate the organo-sodium derivative, the organo-lithium derivatives can be kept for months in solution. The lithium atom appears to possess approximately the maximum reactivity which will still permit the reaction to be stopped at the organo-lithium stage.

Such compounds as methyl-lithium, and phenyl-lithium have opened the way to many organic syntheses, and a great variety of compounds can be synthesised by their aid. All the resources of the Grignard reagent (or nearly all) are available to the lithium syntheses with the great advantage of much enhanced reactivity; often this enhancement is so great that it will overcome such steric hindrance as entirely precludes reaction with the magnesium compound.

The increase in reactivity has to be paid for by the necessity of conducting operations under an inert atmosphere; usually cylinder nitrogen which has been well-dried is satisfactorily inert.

One limitation that had, until very recently, characterised the use of organo-lithium compounds was that derivatives with the lithium atom adjacent to an ethylenic bond were almost unknown. Work very recently published has shown that this limitation has been overcome. The scope for the use of organo-lithium compounds, already very great, has thus been considerably increased.

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## Record Total of U.S. Sulphur

The U.S. domestic sulphur industry produced 475,694 long tons during May, according to reports of producers to the U.S. Bureau of Mines. This was the greatest tonnage ever produced in a single month.

# Metallurgical Section

Published the first Saturday in the month

# Metallurgical Section

5 August 1950

## PRODUCTION & PROPERTIES OF COBALT

### *Increasing Applications of a Versatile Element*

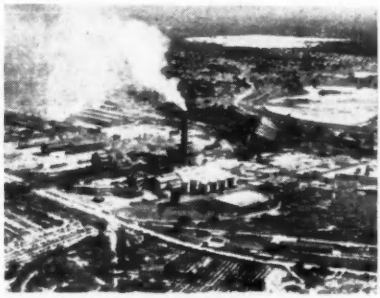
by R. S. YOUNG, Ph.D., F.R.I.C.*

COBALT, element 27 in the periodic table, was known in its crude state to the copper miners of the Hartz Mountains in the sixteenth century and was recognised as a metallic element around the middle of the eighteenth century. Its history well illustrates the shifts in major ore sources so frequently found in the mining industry. Up to the latter part of the last century the small output was derived almost entirely from Germany, Norway, and Hungary. About 1874, oxidised cobalt ores were exploited in New Caledonia and that territory was the leading producer until the beginning of the twentieth century saw the development of the rich silver-cobalt ores of Ontario, Canada.

#### Belgian Congo Development

For twenty years Canada led in cobalt, but about 1920 Union Minière du Haut Katanga began to extract cobalt from its copper-cobalt ores in the Belgian Congo, which soon became, and still remains the largest producer of cobalt. In 1930 the development of the immense copper resources of Northern Rhodesia revealed that one producer, Rhokana Corporation, had enough cobalt to warrant extraction. Since then Northern Rhodesia has been second in world output.

In the mid-thirties the cobalt deposits of French Morocco began to assume importance, and prior to the war they were in third place. Minor producers include Canada, United States, Finland, Burma, Australia, and several other countries. It is interesting to note that



*The smelter at Nkana*

over 75 per cent of the world's cobalt comes from the continent of Africa.

Cobalt occurs in the form of sulphides, oxides, and arsenides and is generally associated with ores of copper, nickel, arsenic, or silver. Over 50 minerals containing cobalt have been described in the literature, and the content of cobalt in the earth's crust is usually estimated at 0.001 per cent, or 1/20 that of nickel. The principal sulphides are carrollite $CuCo_2S_4$, and linnaeite $Co_3S_4$; the chief oxides include asbolite $CoO.2MnO_2.4H_2O$, and heterogenite $CoO.2Co_2O_3.6H_2O$; the main arsenides are safflorite and smaltite $CoAs_2$, skutterudite $CoAs_3$, and erythrite $Co_3As_2O_8.8H_2O$.

The metallurgy of cobalt, depending on the nature of the ore, may include practically all the typical operations of this science. Concentrating practices may entail gravity, magnetic, or flotation concentration; furnace operations occur in the roaster, blast furnace, reverberatory, or electric furnace; while the hydrometallurgy of cobalt embraces all types of leaching, purification, precipitation, or electrolysis.

(*continued overleaf*)

* Director of Research, Diamond Research Laboratory, Industrial Distributors (1946), Ltd., Johannesburg. The author, who is chief research chemist, Anglo-American Corporation of South Africa, has written a monograph on cobalt for the American Chemical Society. He is also chief research chemist of the Rhokana Corporation, Ltd. ; Nchanga Consolidated Copper Mines, Ltd. ; and Rhodesia Broken Hill Development Co., Ltd.

In the Belgian Congo the oxidised cobalt residues from copper leaching operations are purified by removing copper and iron, and cobalt is finally obtained by electrolysis of its sulphate. Some high-grade cobalt ores and by-products are treated in electric furnaces to give a copper-cobalt-iron alloy. In Northern Rhodesia where cobalt occurs as a sulphide, differential flotation and gravity separation followed by separate treatment in reverberatories and converters gives a high cobalt slag. This feeds the electric furnaces to produce copper-cobalt-iron alloy. Where cobalt occurs in the form of arsenides as in French Morocco and Canada, blast furnace and roasting operations give a product amenable to leaching with sulphuric acid.

### Separation Processes

The hydrometallurgy of cobalt usually begins with a dilute acid solution containing cobalt, copper, iron, and frequently nickel and arsenic, which has been obtained by leaching an alloy, matte, or cobalt-containing residue with sulphuric acid. Copper can be removed by precipitation on scrap iron, while iron is eliminated as hydroxide, or arsenate if arsenic is present, by additions of lime under careful pH control. Cobalt is separated from nickel by taking advantage of the fact that in neutral solutions cobalt is more readily oxidised by agents like sodium hypochlorite, and the oxidised compound hydrolyses and precipitates, leaving nickel in solution. Cobalt hydrate is reduced to metallic cobalt by carbon.

In conformity with most metals, the trend in cobalt production is towards treatment by electrolysis to obtain as pure a final product as possible. Most of the Congo production is now electrolytic, and the Northern Rhodesian output likewise should be the product of an electrolytic process within a year or two.

### Cobalt Ammines

The chemical properties of cobalt and its principal compounds are similar to those of its neighbouring base metals, iron and nickel. A large number of complex ammonium compounds with cobalt are known, and in fact many cobaltic salts are not found in the free state and are only known by their ammines.

In its physical and mechanical properties metallic cobalt resembles iron and nickel. All analytical chemists must have been impressed at some time with the colour phenomena of cobalt salts in aqueous solution. The colours have been attributed to changes in solvation or hydration, to degree of saturation of the residual valencies of the cobalt ion, or to the presence of cobalt complexes.

Cobalt is an important alloying element for steels. The best types of tool steels, for taking heavy cuts at high speed on hard materials, generally contain 8 per cent cobalt in addition to the usual tungsten, chromium, and vanadium. Cobalt is a basic constituent of magnet steels, the best type in commercial use containing 35-40 per cent cobalt. The Alnico-type magnets contain from 5 to 35 per cent cobalt depending on their intended use.

In the ferrous field other important uses for cobalt include alloys for high-strength, high-temperature service, for glass-to-metal seals, and in an alloy possessing zero co-efficient of expansion.

In non-ferrous alloys cobalt mixes well with aluminium, beryllium, chromium, molybdenum, nickel, silicon, tungsten, and vanadium. Stellite, a cobalt-chromium-tungsten alloy, and Vitallium, a cobalt-chromium-molybdenum composition, are widely used for high-temperature service. It is no exaggeration to say that developments in jet propulsion and aircraft gas turbines up to the present have been largely dependent on the cobalt-base alloys.

The importance of cobalt in the field

*Diamond-impregnated tungsten carbide drill crown, having a cobalt content of 15 per cent*

of cemented carbides, is as the binder or matrix for the particles of tungsten and other carbides. It is the most satisfactory metal to bond tungsten carbide, and large numbers of key tools in industry, such as lathe tools, grinding wheels, dies, depend on 5-20 per cent cobalt in the cement carbide. Cobalt is one of the best materials to bond with the diamond, and its presence is the cause of the strong attachment of diamonds to a tungsten carbide matrix.

Though cobalt plating itself has not proved of any commercial merit, " bright nickel " plating, in which cobalt is added to nickel, has attained increasing significance in recent years. The addition of cobalt, with nickel formate and formic acid, to the electrolyte gives smooth, bright, hard, ductile deposits of high protective value.

### Glass and Ceramic Colorants

The glass and ceramic industry is greatly indebted to cobalt for one of its most satisfactory colouring agents. Oxidation and reduction in the melt have no effect on the colour, the latter is stable at high temperatures and is unaffected by the presence of silicates. A range of all shades of blue is imparted to glasses and ceramic glazes by varying quantities of cobalt, with or without the addition of other elements.

Another important use for cobalt is to promote the adherence of enamel to steel. There is not an adequate explanation for this effect, and a great deal of research on substitutes for cobalt for this purpose was done in Germany during the war, but without success.

In the broad field of catalysis, cobalt has many important applications. Cobalt salts, usually linoleates or naphthenates, are the best driers for paints and varnishes. Cobalt is the most satisfactory catalyst for the Fischer-Tropsch synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. During the past few years the use of fluorocarbons for the separation of uranium isotopes has emphasised the importance of cobalt in the synthesis of fluorocarbons. $CoF_2$ is changed to $CoF_3$ by passing fluorine over it, and $CoF_3$ reacts with hydrocarbons to replace hydrogen with fluorine.

### Biological Value

A fascinating use of cobalt in recent years has been to prevent deficiency diseases of livestock in many parts of the world. In Australia, Britain, Canada, Kenya, New Zealand, and the United States puzzling diseases of both cattle and sheep were finally traced to a cobalt deficiency. The addition of small quantities of a cobalt salt to livestock feed or to soil is now standard practice in many regions.

Until recently, cobalt, an element known for nearly 400 years, appeared to make slow progress in the arts and industries. As late as 1914 practically all the world's cobalt was sold in the form of oxide for ceramic purposes. Its rapid extension into many fields in the past 35 years is a good augury for the future of this versatile metal.

## *Developing Canada's Cobalt*

SUBSTANTIAL progress is reported in the production of metallic cobalt by the Cobalt Chemical and Refinery Co., at its plant near Cobalt, Ontario, Canada.

The smelter was acquired from the Silanco Mining and Refining Company last year (THE CHEMICAL AGE, *61*, 395). This marked the launching of a new U.K. enterprise in North America as the new company is partially financed by British capital and the work is under the direction of British metallurgists and technicians.

Present efforts are concentrated on getting the plant into continuous commercial production, says a current report in *Foreign Commerce Weekly* (Vol. 39, No. 13). The product so far is believed to contain a rather high percentage of slag but, with the substitution of an electric furnace for the oil furnace now in use in the final reduction process, a product running 97 per cent cobalt is foreseen.

Almost the entire smelter feed of about 10 tons daily is being taken from a 600-ton stockpile built up during earlier operations.

At Silanco's Aguanico mine in Bucke township an estimated 40,000 tons of drilled indicated cobalt ore is under development. When this programme is completed, Silanco plans to use 75 per cent of the capacity of its Colonial Mill for treatment of cobalt ore, with an expected monthly output totalling 90 tons of cobalt concentrate.

In a further development, the Mensilvo mines at Coleman township is operating a 25-ton concentrator and producing about 30 tons of concentrates monthly. Equipment to enlarge its capacity is now being installed for milling 25 tons or ore daily.

*A centrifuge basket, 36 in. diameter, with an electrodeposited covering of pure silver, used for the separation of a pure vitamin*

# SILVER IN CHEMICAL PLANT CONSTRUCTION

## *Some Modern Applications*

THE wider use of silver in the construction of chemical plant has hitherto been hampered by price considerations and by the traditional tendency to look upon the material as a precious metal rather than an industrial component. Up to 50 years ago the price ratio of silver to gold was maintained fairly constantly at approximately 1 to 15. Following the demonetisation of silver, however, the price declined and by 1939 the ratio of silver to gold had fallen to 1 to 100. Prices have since been subject to sharp fluctuations resulting from artificial factors and controls, but at current levels silver can be more economically employed in chemical plant than several other corrosion-resistant materials. Increased consumption by the chemical, electrical and foodstuffs industries may be expected to result eventually in price stabilisation at an economic level for industrial users.

Silver has many valuable properties, some of which are unique. Of particular importance to chemical engineering are its high resistance to corrosion and its softness and ductility after annealing, which render it exceptionally well suited to various fabricating operations.

Silver is unaffected by alkaline solutions and by fused alkalis up to quite high temperatures, resists attack by most organic acids, and has a higher resistance to acetic acid and acetic anhydride both in the liquid and vapour phases than any other metal in common use. Though hot sulphuric acid and all concentrations of nitric acid readily attack silver, more dilute sulphuric acid and phosphoric acid solutions have little effect even at boiling point.

The halogen acids produce a film of silver halide on the surface which inhibits further attack, unless the acid is sufficiently concentrated to dissolve the film. Silver is not subject to the formation of oxides at both normal and elevated temperatures but is attacked by most sulphur compounds. This resistance to attack over a very wide range of conditions rarely depends on the formation of a protective film; it is due chiefly to silver's high position in the electro-potential series, which is exceeded only by the standard potentials of gold and the platinum group metals.

Of major importance in many chemical applications is the fact that silver has a higher thermal conductivity than any other metal. At room temperature the figure is 1.00 cal/(sec.) sq. cm. (°C. per cm.), compared with a figure of 0.94 for copper. This outstanding property plays a valuable part in dissipating the heat generated at electrical contact interfaces.

### High Thermal Conductivity

The heat transfer characteristics of silver and silver-lined chemical plant compares favourably, for example, with those of nickel or stainless steel plant. In favourable conditions, the high thermal conductivity of silver, coupled with its freedom from corrosion, enable very high overall transmission coefficients to be obtained. At 0.056 cal/gm per °C. at 20°C. the specific heat of silver is much lower than that of copper.

The ultimate tensile strength of fully annealed silver is about 20,000/sq. in., while in the work hardened condition it is of the order of 40,000 to 45,000 p.s.i. To overcome its mechanical weakness and liability to sulphur tarnish silver is alloyed with copper and various other metals. In nearly all the available alloys, however,

improved mechanical strength is accompanied by a reduction in the resistance to chemical attack, so that for use under corrosive conditions 99.99 per cent silver is preferred. The subject of alloying, however, has not yet been fully explored. Dr. J. M. Pirie has expressed the opinion that sufficiently active development of certain lines of investigation could yield an alloy which would combine the characteristic corrosion resistance of fine silver with mechanical properties of a reasonably high order.

Both the pure metal and its alloys can be rolled, spun, drawn, etc., the accepted practices differing little from copper technique. Solid drawn tubes are produced up to 2 in. in diameter, tubes of a larger size normally being welded from strip. A number of tubular liners for autoclaves have been constructed, however, each liner being a solid drawn silver tube 30 ft. long, 20 in. diameter and of $\frac{3}{8}$ in. wall thickness. The billets cast for these tubes weighed nearly 2 tons each.

### Bonding Property

One of the most important properties of silver is the ease with which is can be welded or bonded at only slightly elevated temperatures. Pure silver is therefore used to a certain extent as a bonding material in the manufacture of chemical equipment.

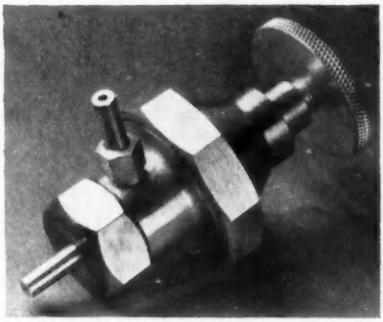
Since silver possesses a low specific heat, a fairly high coefficient of expansion and a high thermal coefficient, special provision has in some instances to be made to enable this expansion to take place without danger of buckling.

The use of solid silver for plant construction is, of course, limited by the cost of the metal and by its low tensile strength. Massive silver is therefore used mainly where thin-walled structures and low unit stresses are permissible. The principal application of this nature is in the construction of tubes and coils subject to low working pressures.

### Fine Tubing

For service at higher pressures, silver tubes and pipes are backed with a stronger metal by drawing down together a pair of heavy-walled tubes, one of silver, the other of base metal. In heat exchangers the silver tubes are expanded to fit tightly in the tube plates, which are usually of base metal sheathed with silver on the contact face and through the holes. Fine silver tubing is extensively used in the form of coils for heating, cooling, and small-scale condensing operations.

Where all risk of contamination of the contents by base metals must be avoided, small pans and vessels may be constructed



*A diaphragm-sealed control valve for liquid bromine: all parts coming into contact with the working fluid are constructed of solid silver*

entirely of silver. Solid silver, often in cast form, is used for small parts which cannot readily be lined, such as plug cocks and various pipe fittings. Small and complicated cover plates for pressure vessels are made in a similar manner.

Though the initial cost of silver plant is high, this is largely offset by the recovery value when a plant or vessel is taken out of commission. It may be more economical in the long run to employ solid metal even in thick sections, than to attempt to line difficult constructions.

### Cladding Technique

Because of the relatively high cost of silver, however, the most widespread use of the metal in chemical plant is in the form of liners, pre-formed to fit a base metal shell or tube. The cladding or inlaying technique is also extensively used, to produce silver-clad copper, phosphor bronze and steel sheet, silver inlays or stripes, and silver-clad copper and other metals in wire and tube form.

Copper is the most widely used backing metal. In a standard type of steam-jacketed pan used in the food processing and other industries, the lining is made up, for example, from sheet about 0.03 in. thick. This is rolled and hand worked to shape, the edges of the sheet being joined by gas welding using a fine silver filler rod. The liner is made to fit closely in the shell and the surfaces to be in contact are coated with an alloy of low melting point. After the liner has been inserted the pan is heated and the silver pressed into firm contact. This method produces a strong bond which allows a high rate of heat transfer through the double wall and cannot easily be loosened at ordinary working

temperatures. Many complex shapes can be lined in this way. Mild steel vessels can also be given a bonded lining if the steel shell is not too heavy. Bonding is not practicable in thick-walled vessels such as high-pressure autoclaves, the method usually adopted being to make the liner slightly oversized and press it into place.

### Jointing Methods

In general, the design of vessels or structures to receive a silver lining seldom presents any serious problems, nor is jointing difficult. The joint between the body and head is made by carrying the silver over flange faces and pulling up against a soft gasket by means of backing rings. Pipe joints may be made in the same way, or in the case of solid wall the methods applicable to copper piping may be employed. All jointing methods ensure that liquids or vapours in the system are in contact only with silver. Hence it is possible to build plant assemblies with silver contact surfaces throughout the system. Since silver surfaces easily bind together, special consideration must be given to parts such as agitator seals, cock and valve seatings, etc., which are in moving contact.

The fitted lining provides a very satisfactory working surface for many conditions and is readily recoverable, but there are disadvantages. Unless the lining is carefully bonded, there is a risk of collapse when working under vacuum, particularly at temperatures above 200° C., when the strength of the bonding medium is low. Moreover, the production, fitting and bonding of a liner into vessels of complex design adds considerably to the original labour of construction. Sheets less than 0.03 in. thick cannot be conveniently fabricated and handled, whereas for many applications ample protection would be afforded by a considerably smaller weight of silver.

### Problem of Porosity

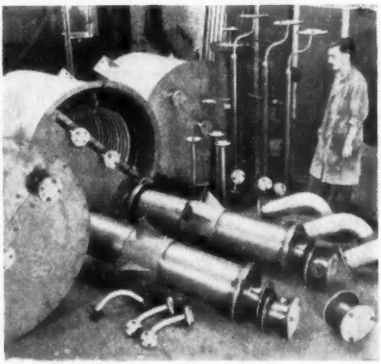
Uniform coatings of silver as thin as 0.001 in., or even thinner, can be applied by electrodeposition or metal spraying, but are too porous for chemical process work. A homogeneous deposit may be obtained by carefully building a heavy layer, but even with thick coatings complete freedom from porosity is difficult to guarantee. This method is used for such articles as centrifuge baskets, paddles of Werner-Pfleider type mixers, and other work which cannot readily be sheet lined or made solid.

A promising method, likely to become important, is the cladding of a silver sheet on a base metal plate before fabrication. Under carefully controlled conditions a very strong bond is produced which enables the composite plate to be worked as a single element. Some difficulties still exist but once the technique has been mastered it seems probable that the first cost of silver-lined plant may be considerably reduced and its range of application extended.

The scope for silver or silver-lined plant is extremely wide. In inorganic processes the field is limited mainly by the inability of silver to resist attack by nitric acid and concentrated sulphuric acid. It is also limited by the availability of cheaper alternative materials. Silver is used, however, in handling cold hydrofluoric acid, dilute sulphuric and hydrochloric acids, etc., and has numerous applications in the manufacture of medicinal chemicals and pharmaceutical preparations. It is also used as a ladle and mould material for making very pure castings of sodium and potassium hydroxide, and in pipes and valves for handling chlorine.

### Organic Processes

In organic processes silver is used in the presence of many acids, such as acetic and maleic acids, and in the presence of phenol and phenolic derivatives. One of the most extensive applications in this field is in the condensation and general handling of acetic acid, which at the moment of condensation is particularly corrosive. This caused considerable difficulty to manufacturers who used copper containers, but has been solved by the use of silver.



*Multitubular condensers, cooling coils, vapour pipes and miscellaneous fittings all constructed of pure silver for an acetic anhydride plant.* (*The accompanying illustrations are reproduced by courtesy of Johnson, Matthey & Co., Ltd.*)

# CHROMATE PROTECTION FOR METALS

From A SPECIAL CORRESPONDENT

BICHROMATES and chromates have for a number of years found important applications in corrosion prevention and are still considered to be among the best inhibiting materials available in industry.

Chromate treatments for metals may be in the form of a dip or electrolytic processes, which are designed to inhibit or control the rate of corrosion of the metal or to promote the formation of a protective film. Probably one of the most easily applied and efficient anticorrosion methods for the protection of magnesium alloy surfaces consists of cleansing the metal by degreasing, immersing for 5 to 10 minutes in a 15-20 per cent solution (by weight) of hydrofluoric acid at 65° F., rinsing thoroughly with cold water and boiling for 45 minutes in a solution containing 10-15 per cent by weight of sodium bichromate (as dihydrate).

### Corrosion Prevention

Tinplate to be used for canning also can be adequately protected against blackening caused by sulphur-containing food by immersion in an alkaline phosphate-chromate solution. This treatment reduces the amount of tin absorbed by the food and it also has the effect of retarding the rusting of tinplate in moist air.

An early use for sodium bichromate as an inhibiting agent which is still important is in refrigeration, where the introduction of this chemical in the circulating brine affords protection against corrosion. Usually percentages varying from ½ to 1½ per cent of the weight of sodium chloride or calcium chloride are effective, providing the *p*H of the brine is within 6.8 and 8.5 acid.

Generally, in the field of corrosion prevention it is necessary to ensure that the chromate ion is present in the *p*H 7.5-9.5. Conditions, therefore, call for the use of sodium chromate, which is frequently made by treating the cheaper sodium bichromate with caustic soda, 27 lb. of caustic to every 100 lb. of sodium bichromate being required to attain the proper *p*H.

Chrome pigments, particularly calcium, strontium, barium and zinc chromates, owe their great value in the manufacture of paint primers to their corrosion-inhibiting properties. These pigments function by virtue of their controlled release of the water soluble chromate, the pigments being soluble to the extent that a small amount of chromate will "bleed" from the pigment when in contact with moisture and the chromate ion will then exhibit its characteristic properties of inhibiting corrosion.

### Protective Films

Soluble chromates cause the formation of closely adhering protective oxide films on the surface of metals and so prevent their attack by known corrosive solutions, as in the employment in operating or reserve boilers of a small quantity of soluble chromate in the water to prevent corrosion of the metal. The minimum concentration recommended for idle boilers is about 200 p.p.m. and in the working boilers the concentration should be increased until the blow-off liquor shows about 400 p.p.m. The latter is effective up to a pressure of about 200-250 p.s.i.

Where the chloride content of circulating water is increased through evaporation of the water—the real danger point being about 1000 p.p.m.—the presence of sodium chromate to the extent of 500-1000 p.p.m. in the water will effectively control corrosion.

The inhibiting properties of chromates are utilised quite extensively in this way; for example, the cooling of diesel engines with water containing soluble chromates will prevent the formation of rust and scale. Here the concentration of the chrome salt depends on the type of cooling system in use. If the same cooling water is used for very long periods without changing then a high concentration of chromate, as much as 5000 p.p.m., is required.

Where too small a percentage of chromate is used there is always a danger of serious localised corrosion taking place and it is, therefore, important to determine the optimum quantity needed for each type of application. Too high a concentration of chromate may, on the other hand, also present problems, as it will in gas condensate wells if excessive amounts of chromate are present. It is then likely that deposits of hydrous chromic oxide will be formed in the effluent water.

The use of chromates in air conditioning units derives a special interest from the circumstance that the corrosion problem is aggravated by the common use of dissimilar metals. It is difficult to prescribe an inhibitor which will effectively protect

(continued at foot of next page)

# Rising Level of N-F Metal Stocks

STOCKS of the principal non-ferrous metals in June, held by Government and consumers, were larger than in the corresponding month last year. Among the increases (1949 figures in brackets) shown by the British Bureau of Non-ferrous Metal Statistics were blister copper 46,204 long tons (38,787); zinc in concentrates 29,316 (13,841); lead in concentrates 72 (51); imported virgin lead 67,857 (55,614); English refined lead 6262 (4034).

Production increases were noted in slab zinc 6933 (5871); lead in concentrates 241 (198) and English refined lead 6593 (2777), but there were decreases in the output of blister copper 1498 (3280) and refined copper 15,558 (16,122).

Imports were also generally higher than they were in 1949 and in May this year.

**UNWROUGHT COPPER**

| | Long Tons | |
|---|---|---|
| | Blister Copper | Refined Copper |
| OPENING STOCKS : | | |
| Govt. and consumers' ... ... | 43,083 | 81,208 |
| Imports ... ... ... ... | 13,068 | 17,691 |
| PRODUCTION : | | |
| Primary ... ... ... ... | — | 9,110 |
| Secondary ... ... ... | 1,498* | 6,448 |
| CONSUMPTION : | | |
| Primary ... ... ... ... | 9,230 | 26,827 |
| Secondary ... ... ... | — | 17,672 |
| Exports ... ... ... ... | 1,049† | 26 |
| CLOSING STOCKS : | | |
| Govt. and consumers' ... ... | 46,204 | 78,992 |

* Rough copper.

† Rough copper despatched to Belgium for refining on toll.

OUTPUT OF COPPER, ALLOY AND PRODUCTS

| | |
|---|---|
| Unalloyed copper products ... ... | 25,873 long tons |
| Alloyed copper products ... ... | 26,320 ,, ,, |
| Copper sulphate ... ... ... | 4,933 ,, ,, |

**UNWROUGHT ZINC**

| | Long Tons | |
|---|---|---|
| | Zinc in Concentrates (estimated gross zinc content) | Slab Zinc (all grades) |
| OPENING STOCKS : | | |
| Govt. and consumers' | 32,855 | 49,841 |
| Imports ... ... | 5,327 | 16,768 |
| PRODUCTION : | | |
| Virgin and remelted | — | 6,933 |
| CONSUMPTION : | | |
| Virgin (incl. debased) | 8,866 | 20,323 |
| Remelted and scrap | — | 7,558* |
| Exports and re-export | — | 10 |
| CLOSING STOCKS : | | |
| Govt. and consumers' | 29,316 | 52,722 |

* Includes small quantity of zinc in concentrates consumed directly for chemicals, etc., which is also included as consumption of concentrates.

**LEAD**

| | Long Tons | | | |
|---|---|---|---|---|
| | Lead in Concentrates | Imported Virgin Lead | English Refined | Lead Content of secondary Scrap and Residues |
| OPENING STOCKS : | | | | |
| Govt. and consumers' ... | — | 60,169 | 5,154 | — |
| Other stocks ... | 90 | — | — | — |
| IMPORTS ... ... | — | 22,762 | — | 653 |
| PRODUCTION ... | 241 | — | 6,593 | — |
| CONSUMPTION ... | 259 | 14,300 | 5,485 | 7,592 |
| EXPORTS ... ... | — | 3 | — | — |
| CLOSING STOCKS : | | | | |
| Govt. and consumers' ... | — | 67,857 | 6,262 | — |
| Other Stocks ... | 72 | — | — | — |

**CHROMATE PROTECTION FOR METALS**

(*continued from previous page*)

several different metals, such as steel, copper, aluminium and zinc. Chromates are fortunately able to inhibit corrosion, provided optimum quantities are used. Here again the percentage used must depend on several factors, such as the extent of the rust and scale in the system; temperature of the circulating water; *p*H; concentration of all dissolved corrosive salts and also the nature of gases and vapours present in the air as it is drawn into the air conditioning unit. A fairly common practice is to have an initial concentration of 500 p.p.m., sufficient to effect an immediate cleansing of the system, and to reduce this to about 100 to 300 p.p.m. as a working strength.

In the U.S.A. chromates are utilised in oil well drilling to control the corrosion of drilling tools subject to corrosion fatigue. The Diamond Alkali Company, Ohio, which has carried out a great deal of development work on the use of chromates as corrosion inhibitors recommends the addition of chromates to the drilling mud. By this means it is said that the frequency of drill string failure can be reduced by 50 per cent or more, and the mud handling equipment will also benefit from the corrosion protection.

OVERSEAS CHEMISTRY AND INDUSTRY

# WIDER HORIZONS IN GERMANY

## *More Oil, Chemicals and Synthetic Fibres*

GERMAN coal-oil and hydrogenation interests are continuing their efforts to secure further relaxation of Allied restrictions of production. Negotiations are in progress, the intention of which is to secure the resumption of operations in the Scholven hydrogenation plant. Scholven-Chemie AG, Gelsenkirchen-Baur, hopes to obtain a permit for a monthly throughput of 15,000 tons of residual mineral oils. The hydrogenation industry is also pressing for preferential treatment in taxation matters on the ground that it can provide larger quantities of motor fuels from imported crude oil than the refineries can and is capable of utilising coal-tar products of which increasing stocks are being accumulated.

The OEEC Mineral Oils Committee has given its consent to German proposals for the erection of new cracking plant with a total capacity of 1.1 million tons annually, in addition to the existing capacity of about 500,000 tons and the Esso installation of 400,000 tons annually which is to be built at Harburg. Work has now begun on the erection of a new 600,000 ton oil refinery at Lingen, Emsland, which is exclusively to treat crude from the Emsland oilfields. These are now supplying approximately half the total West German crude petroleum output which in the first half of 1950 amounted to 525,000 tons, compared with 380,000 tons in the corresponding period of the preceding year.

### Recovery of Individual Firms

Recent shareholders' meetings of leading West German chemical firms have furnished an interesting commentary on the rapid recovery of individual industries. Elektrochemische Werke München AG, which last year partly rebuilt its hydrogen peroxide plant at a cost of about Dm. 3 million, reports a further improvement in production and sales and resumption of old contacts for persulphates with Greece, Italy, France, Britain and Switzerland. It is expected to reach 50 per cent of the former capacity by next Spring. Sachtleben AG für Bergbau und Chemische Industrie, Cologne, has regained the pre-war level of lithopone production and almost reached the 1938 export volume; exports last year already accounted for half the total sales.

Casella, Fechenheim-Main, is approaching the pre-war level of production. Exports here account for more than one-third of the total sales. The company has started the manufacture of a number of new intermediates, dyes, pharmaceuticals and specialities for the textile industry; these now constitute a third of the total production. AG für Chemische Industrie, Gelsenkirchen-Schalke, which produces lithopone, sodium sulphate and carbon disulphide, is operating its factory at 75 per cent of pre-war capacity and views the prospects with confidence. Süd-Chemie AG, Munich, has carried out important extensions and reports that substantial export gains are largely responsible for the favourable situation.

### Artificial Fibre Factories

Perlon fibre is now being produced in all four occupation zones—at Schwarza (Thuringia) in the Russian zone, at Uerdingen (North Rhine-Westphalia) in the British zone, at Bobingen (Bavaria) in the U.S. zone and at Freiburg (South Baden) in the French zone. The three West German plants intend to extend operations considerably before the end of this year, and another factory, the Farbenfabriken Bayer works at Dormagen, is to enter the Perlon field shortly. Kunstsiedefabrik Bobingen AG, which hopes to double its Perlon production—now stated to be 30 tons a month—in August, is negotiating with AG für Plastikindustrie, Romanshorn, Switzerland, about a long-term contract under which definite quantities of Bobina-Perlon are to be supplied to the Swiss firm for five years in return for a Dm. 7 million loan for extension of the Bobingen works.

The works at Dormagen have made considerable progress in overcoming damage due to neglect of repair work during the war. Special-purpose fibres made at Dormagen include Crinex, a cellulose fibre for upholstery, Dorix cellulose-basis bristles, Dorlon bristles, a fully synthetic product, Dralon for fishing tackle, and PeCe-U bristles. The West German production of rayon and rayon staple continued to increase this year and in the first six months of 1950 rayon amounted to 24,393 metric tons (first half of 1949 23,673) and staple fibre to 56,145 metric tons.

# SODIUM CHEMICALS FOR INDIA

## *Current Proposals to Forward Industrialisation*

CHEMICAL and allied industries are bound to play a rôle of increasing importance in India's project to become self-supporting in respect of many products now imported. Salt, as the primary source of most sodium-containing substances and of chlorine and hydrogen chloride, is therefore of vital importance in the country's industrial development.

Self-sufficiency in the salt industry is anticipated by 1951 (THE CHEMICAL AGE, *63*, 162), and publication of a booklet "India and the Salt Industry," by Sri E. B. Tisseverasinghee, B.Sc.(London)* affords a useful review of the problems which have to be considered.

### Three Million Tons a Year

There is practically no industry, the author points out, that does not call for the use of sodium salts at some stage, while the chlorine products, at one time largely neglected, are becoming more and more in demand.

There is scarcely any foreseeable limit to the industrial uses of common salt. He cites the fact that the U.S.A. uses approximately 170 lb. of common salt per head per annum for industrial purposes. On the same basis, India would require over 25 million tons of salt yearly. The author admits that is not likely to be even approached within the lifetime of any of the present generation.

Yet any industrialisation at all would call for large quantities of common salt, and it would be unwise if India were to provide for a productive potential of less than about 3 million tons of common salt for industry within the next 10 or 15 years. It would be most dangerous for an Indian chemical industry to develop without assuring itself of an adequate indigenous production of common salt.

One of the first problems is, of course, to determine where salt could be produced most economically.

Industrial salt is dependent to a far greater extent on proximity to sources of cheap fuel and power, and to users of the products. Bombay and Calcutta, Mr. Tisseverasinghee points out, are obvious places where cheap salt is urgently required. Not quite so obvious are the fish-curing areas. Proximity of limestone, clay, gypsum, etc., also has its own influence on such advice.

He considers it is practicable to site a new salt factory where natural conditions prove favourable, and thereafter to shift plant whenever a sufficient large-scale or profitable demand is made by any industry.

To meet industrial demands cheap production from new sources in the south or east are essential. If a suitable area can be found half the problem will be solved.

In India salt production should be almost exclusively by solar evaporation up to at least the point where saturated salt brine is produced. Beyond that point in the initial stage of a new industry, the processes must be entirely solar evaporation, with collection of salt by manual means. But provision would have to be made to manufacture a limited quantity of salt by a boiling process.

If this could be done cheaply, there would be an immediate market for the whole output. Even if it was costly, it would still be saleable in smaller quantities. The whole question is based on the economics of fuel and power.

The author considers it safe to predict that much of the salt will eventually be produced by boiling down saturated brine, produced by solar evaporation.

### Sea Water Salterns

For solar evaporation the structures required are mainly earthworks. Since total requirements, both domestic and export, may eventually absorb five million tons, it would not be unreasonable to enclose an area on an equivalent scale.

Such pans would be fully economic even if only one-tenth of the full capacity was employed at first. The sea water which would be employed contains a number of other salts from which gypsum, magnesia and potassium chloride can be obtained.

The fertiliser project at Sindhri requires about 3-400,000 tons of gypsum annually which at present it is proposed to bring by rail from Rajputana, over 1000 miles away, or from overseas. Similarly the proposed new steel factories for Bihar and Assam would require large quantities of refractory quality magnesia which could be profitably supplied from the saltern enterprise.

* In 1944 Sri E. B. Tisseverasinghee was given charge of the Ceylon Salt Department. Since then he has made a special study of salt and the related industries. He has visited most of the salt-producing centres in North and South India and published a Treatise on the future potentialities of the salt industry (Ceylon Sessional Paper No. B 1948).

Potash is also inadequate in most tropical lands, so that an enterprise such as an integrated salt manufacturing scheme which would combine three technical processes, would well deserve the support of the Government of India.

Another aspect of India's sodium chemical requirements, caustic soda, has been ably reviewed by S. G. Sastry in the *Journal of Scientific and Industrial Research* (Vol. 19, No. 6).

He estimates the present demand for caustic soda in India to be 70,000 tons a year, while the production in the country is not more than 10,000 tons a year. The balance of 60,000 tons is obtained by imports mainly from England and, more recently, from America, Belgium and other countries.

From the national point of view, he urges, it is imperative that this industry should be expanded, and every encouragement given to those who have started manufacturing this key chemical.

### Costly Production

Generally speaking, the author points out, the cost of producing caustic soda in India is much higher than in other countries. There are several reasons: (a) capital costs in India per unit production are higher than in other countries; (b) scale of operations is small and the proportion of overhead expenses and salaries of technical staff is proportionately high; (c) neither high purity common salt nor high purity lime is available in India; (d) the cost of fuel in India is higher than in other countries; (e) the freight charges on Indian railways are high; and (f) except in Mysore and at Mettur the cost of electric power is high.

The important requirement now was to step up the scale of operations and so bring down the price of the product. It was unfortunate that even in areas where there was a sizeable demand for caustic soda, industrialists did not co-operate in a common endeavour.

In Bombay, for example, there are textile mills, soap factories, vegetable oil refineries and a new rayon factory. The total annual demand of these and a large number of other industries needing caustic soda would require at least 10,000 tons. Yet there was not one large caustic soda factory with this output.

Instead of evaporating the liquor to solid caustic soda involving heavy expenditure on fuel, the caustic soda required by the factories could be supplied as liquor in tank wagons. If the manufacturers would not co-operate, the Government of India should establish a large caustic soda plant within the Bombay area and compel all users of caustic soda and chlorine to take their supplies from it.

It should be possible to have jointly owned caustic soda factories at Ahmedabad, Coimbatore, Bangalore, Calcutta, Kanpur and Delhi. If these co-operative or jointly owned factories came into existence imports of caustic soda might be gradually abandoned.

India is depending mainly on sea salt for her industrial needs and the salt manufactured is unfit for chemical industries. The Government of India should take steps to improve the methods of salt manufacture.

Research in this direction was started under the auspices of the Council of Scientific & Industrial Research, but the problem does not appear to have been pursued to its logical end. The council, says Mr. Sastry, should also explore the possibilities of utilising surplus chlorine in industry.

## Italy's Natural Gas

FAVOURABLE results are reported to have been achieved in the exploitation and distribution of Italy's considerable natural gas resources, although less success appears to have attended the efforts to locate commercial quantities of oil. An increasing output of natural gas is announced by the State-owned Ente Nazionale Metano, the amount for 1949 (in million cubic metres) being 247.33, against 135.81 in 1948, 98.68 in 1947, and 27.77 in 1940.

Industrial and domestic users in 1949 consumed 145.99 million cu. m., an increase of more than 100 million over 1948. An idea of the extent of the development of these natural gas resources in the last decade is gained from comparison with the consumption by the same group of consumers in 1940, which was only 2.32 million cu. m.

Natural gas used in Italy last year as motor fuel amounted to 68.09 million cu. m., compared with 58.07 in 1948, 54.76 in 1947, and 16.74 in 1940. The Italian Ministry for Industry indicates that output in the first few months of this year fluctuated between 1.2 and 1.3 million cu. m. per day.

Experts are confident of further increases in the output from many of the natural gas occurrences in Italy. A five-year plan by the Ente Nazionale Metano provides for 21 new test drillings as well as for the further development of some 38 previously located sites. Drilling equipment, the lack of which is said to be holding back operations, is to be acquired with the aid of ERP funds.

# Technical Publications

THE tendency to employ higher temperatures and higher steam pressures in power plant operation has created problems for feed pump designers striving to meet requirements for both normal and emergency conditions. One of the main problems is due to the rapid expansion of the component parts of the pump assembly which may cause distortion and move the bearings out of alignment. To meet this problem a new feed pump has been designed by the Harland Engineering Co., Ltd., and is described in the current issue of "Wiggin Nickel Alloys" (Henry Wiggin & Co., Ltd., Birmingham). The pump has only one high pressure joint between the casing and the massive steel end cover, and for this a cupro-nickel corrugated joint ring is employed. The ring is clamped between two flat plates of forged steel and is said to give a greater margin of safety in respect of temperature fluctuations than the plain metal-to-metal joint. The use of a cupro-nickel ring also permits a lower bolt tension to be used. Tests have shown that these joints will withstand a steam pressure of 300 p.s.i. at 500° F.

* * *

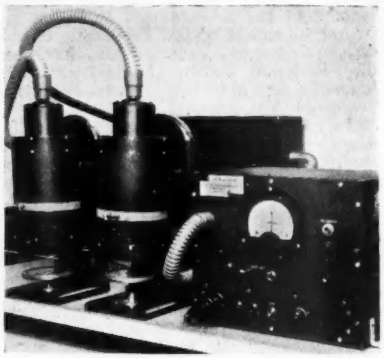
ABSORPTION determination and instruments form the principal features in "The Bulletin and Laboratory Notes" (Series II, No. 16) now available from Baird and Tatlock (London), Ltd. A description is given of the BTL self-balancing photoelectric absorptiometer designed to record the composition of any liquid whose absorption can be related to some form of chemical analysis or turbidity. The instrument was produced in collaboration with I.C.I., Ltd., which was responsible for the fundamental design and much of the development. Other articles include a description of the completely redesigned Spekker absorptiometer and a study of the determination of soil moisture control values by the gypsum absorption cell.

* * *

NATURAL rubber is the subject of a comprehensive survey issued as a supplement by the *Financial Times* this week. The chemical problems of ageing are discussed by Dr. Geoffrey Gee and other articles deal with extending applications of rubber, post-war growth of the industry in the U.K., the progress and promise of latex foam and the need for research.

* * *

THEORETICAL considerations in the operation of iron blast furnaces with cold oxygen carbon-dioxide blast are discussed by William Bleloch, Ph.D.(London), F.R.I.C., M.I.Chem.E., in the *Journal of the Chemical Metallurgical and Mining Society of South Africa* (Vol. 50, No. 11).



[By courtesy of Isotope Developments, Ltd.

*The first British non-contact beta gauge incorporating radioactive isotopes to measure weight per unit area of sundry materials in sheet form* (THE CHEMICAL AGE, 62, 920). *Tracer material, such as $P^{32}$, in the two ionisation chambers provides the beta radiation by which it is already possible to measure thickness in the range* 1-150 *mgm/sq. cm. Stronger source of radiation may increase the range to* 1 *gm/sq. cm.*

* * *

*IMPACT* is the title of a new quarterly bulletin, published by UNESCO, of which the first issue is now available. The object, according to the foreword, is the collection of information on the various aspects of the international and social implications of science and to present the material in the form of readily available abstracts.

* * *

THE comparative novelty of high vacuum technique in general industrial and laboratory use is called to mind in a digest published in booklet form by W. Edwards & Co. (London), Ltd. This provides an index of available equipment and components and serves as an introductory manual for studying new products.

* * *

NEW and used handling equipment and prime movers with a wide range of applications are described in "Plant" (Vol. 2, No. 5) obtainable from Chamberlain Industries, Ltd., Leyton, E.10.

# The Chemist's Bookshelf

STREPTOMYCIN. Edited by S. A. Waksman. 1949, London. Baillière, Tindall & Cox. Pp. ix + 618. 76s. 6d.

This book is of prime importance to workers in antibiotics and tuberculostats. Edited by Waksman, the discoverer of streptomycin, there are 46 chapters arranged in four sections. The 58 contributors' connections range from the academic to the industrial. In recent years the Americans have achieved great success in securing the collaboration of workers with academic, medical and industrial backgrounds in the attack on common problems. This has been most notable in the production of penicillin by the submerged mycelium fermentation and in the all-American discovery and production of streptomycin.

The book claims to summarise the present status of the subject. There are, however, formidable difficulties in producing a book of this character by so many specialists; overlapping is inevitable. It is not reasonable to expect continuity of narrative and the volume must be tested on its merits as a symposium. On this basis the volume is most successful, both in detail and comprehensiveness.

The four sections of the book are as follows: (1) Microbiological and chemical aspects; (2) Antibacterial and pharmacological properties of streptomycin; (3) Clinical use of streptomycin; (4) Miscellaneous uses of streptomycin. Readers will find the main interest in the first two sections. The book is, perhaps, somewhat uneven in that only 12 per cent of the pages are concerned with Section 1 and 27 per cent with Section 2. This tends to emphasise the medical aspects.

Chapters 1 and 2 are devoted to a historical introduction and to a discussion by the editor of the nature and nutrition of *Streptomyces griseus*, written in his usual lucid style and from his own specialist approach. Chapter 4 deals with the production and isolation of streptomycin. The author is quick to warn (p. 33) that the reader will find none of "the significant details of the existing industrial processes." This is not surprising, but it makes the book less valuable to the chemical engineer. We are assured, however, that the basic steps "remain essentially unchanged."

The chapter does, however, indicate the approach to the problems involved. A special instance is the concentration by adsorption, which contrasts with the solvent extraction techniques used in penicillin manufacture.

There is a basic paper by R. L. Peck *et al.* on the technique of adsorption on columns of adsorbent material but whether the technique has been successfully applied in practice is left open to doubt. What is already known about methods of purification by precipitation (*e.g.*, through the reineckate) and by crystallisation as a so-called double salt (*e.g.*, with calcium chloride) is summarised. The author does concede, however, that purification through the calcium-chloride complex is being carried out on an industrial scale.

Dihydrostreptomycin, isolated during important attempts to elucidate the structure of streptomycin, is important because, compared with streptomycin, the onset of vestibular dysfunction is delayed. It has been used quite widely. Tishler discloses that the catalytic hydrogenation of streptomycin has been adapted to large-scale production but does not describe the character of the adaptation. A further chapter gives details of bacteriological and chemical methods of assay. The presentation is not critical.

Streptomycin therapy is complicated not only by streptomycin resistance but also by actual dependence. Miller, who has specialised in this subject, jointly contributes chapter 10 on the complicated problems in biology and genetics arising from these causes. The authors critically examine present theories and the wider implications of the phenomenon. Other chapters in section 2, of particular interest to the biologist and pharmacist reader, on the antibacterial and pharmacologic properties of streptomycin, deal with the mode of action of streptomycin; synergisms in which streptomycin may be involved; absorption and excretion of the antibiotic; and finally, a chapter on the pharmacology proper. Section 2 is, on

the whole, much more adequately treated than Section 1.

Sections 3 and 4 will be of less interest, though a layman, on the fringe of the medical and veterinary aspects of the topic, might consider them of value.

The book is well bound and beautifully printed on excellent paper. References at the end of each chapter are adequate. The subject index is sufficient. Tables and chemical formulæ are clearly presented. There are 95 figures including graphs and photomicrographs; these are, however, not listed.—G.C.G.

PHENOLIC RESINS—THEIR CHEMISTRY AND TECHNOLOGY. P. Robitschek and A. Lewin. 1950. London: Iliffe & Sons, Ltd.; 30s.

This is a useful book for the student preparing for the new API examination who wants to know all about first principles rather than manufacturing details. In 261 pages the authors have covered their subject in a broad informative manner and this treatment, acceptable to the student, leaves something to be desired by the chemist and technologist. It is disappointing to find only 13 pages in Chapter 6 devoted to the actual production of phenolic resins and out of this total some three pages are spent on the "Laboratory Preparation". The plastics industry today is keenly interested in continuous methods of resin manufacture, and this the authors dismiss in a few lines. As this book claims to deal with new trends as well as established methods, this omission is a serious one. There is a lack of information about nitrile rubber modified phenolic resins, which are becoming important where great toughness and a low modulus of elasticity in tension are required. Another disappointment is the paucity of information about new applications of phenolic resins—only three lines are given to phenolic exchange resins. and the same wordage covers the use of phenolic resins in coatings. Chapter 15, dealing with applications. should have been greatly extended.—P.S.

FORTSCHRITTE DER ALKALOIDCHEMIE SEIT 1933. Dr. Hans-G. Boit. 1950. Akademie Verlag Berlin. Pp. xvi+425. Price 53 Dm.

The book, No. 2 of the series "Scientia Chimica", presents a most comprehensive survey of the progress in 1933-1949 in the field relating to the constitution and synthesis of the alkaloids. It aims at making the reader acquainted with a special subject, the international literature of which has not been adequate since before the war. It can be considered as a sequel to the monographs on alkaloids by R. Seka, E. Winterstein and G. Trier, which dealt with the development of alkaloid chemistry up to 1932.

The book is divided into two parts. The first (pp. 2-340) deals in 25 chapters with alkaloids of which the constitutional formulae and eventual synthesis were established and grouped with the compounds to which they were related. The second part (pp. 341-401) comprises alkaloids of constitution hitherto unknown, divided into the two main groups of cryptogames and phanerogames. The alkaloids are arranged according to their origin or to the heterocyclic ring which they contain, and are represented by graphic formulae as far as those are established. They were usually extracted from plant tissues by lixiviating the finely divided tissue with acidified water, neutralising and filtering the product. The present book demonstrates the value of some new methods.

As the alkaloids form an extremely important group of compounds on account of their physiological properties and are the active principles of the common vegetable drugs, this book should appeal to the chemist as well as to the biologist, pharmacologist, pharmacist and the medical man. The great number of alkaloids dealt with can be judged by the fact that its subject index lists in alphabetical order more than 2000 compounds, apart from a great number of references in footnotes. It throws some light on very recent researches, some, dealt with in an addendum, as late as February this year.—F.N.

## *Books Recently Received*

BORON TRIFLUORIDE AND ITS DERIVATIVES. H. S. Booth and D. R. Martin. 1949, London: Chapman & Hall, Ltd. New York: John Wiley & Sons, Inc. Pp. ix+315. 40s.

A CONCISE APPLIED PHARMACOLOGY. F. G. Hobart and G. Melton. 1949, London: Leonard Hill, Ltd. Pp. xxviii +234+viii. 21s.

PHYSICAL METHODS IN CHEMICAL ANALYSIS. Vol. 1. Edited by Walter G. Berl. 1950, New York: Academic Press Inc. Pp. xiii+664. $12.00.

PRACTICAL APPLICATIONS OF SPECTRUM ANALYSIS. H. Dingle. 1950, London: Chapman & Hall, Ltd. Pp. ix+245. Plates XIX. 40s.

CHEMICAL ENGINEERS' HANDBOOK. Edited by J. H. Perry. 1950, New York, London and Toronto: McGraw-Hill Book Co. Inc. Pp. xv+1942. 144s. 6d.

CHEMICAL INDEX OF MINERALS. M. H. Hey. 1950, London: Published by British Museum. Pp. xx+609. 30s.

# OVERSEAS

### No Reduction in Whaling Quota

The International Whaling Commission has decided not to reduce the quota of whales to be caught each season in the Antarctic.

### More Du Pont Patents for Licensing

With the addition recently of a further 462 of its U.S. patents to the list available for licensing, E. I. Du Pont de Nemours & Co., has now made available a total of 5400 patents, or about three-quarters of those owned by the company.

### Indian Fertiliser Loan Proposed

The Government of Madras is examining a scheme for offering a loan of Rs 25 per acre of cultivable land where ammonium sulphate is applied under their programme of intensified cultivation in specified districts. A subsidy system also continues to operate.

### Wages Increase in U.S.A.

A new agreement between Dow Chemical of Canada and the local section of the United Mine Workers of America, which has been ratified by both sides, provides a 10-cents hourly wage increase as from the beginning of this year and improved social security features. At the end of one year wages will be advanced another 5 cents per hour.

### Norway to Increase Iron-Ore Output

The Kirkenes iron-ore mines in Northern Norway—the most important in the country—owned by the A. S. Sdvarangar, are being expanded at a cost equivalent to about £9 million. It is expected that annual output will aggregate 500,000 metric tons by the end of next year and about one million metric tons from the beginning of 1952. Norway's iron-ore output last year was 375,000 metric tons.

### Fats from Oil-Bearing Seeds

Two subjects discussed at a joint meeting of the Nutrition Advisory Committee of the Indian Council of Medical Research and the Animal Nutrition Committee of the Indian Council of Agriculture, held in Bangalore recently, were the desirability of solvent extraction of fat from oil-bearing seeds and cakes to increase the available supply of oil in India, and the possibilities of the cultivation of soya bean on a large scale. For the purpose of studying the problems involved in the solvent extraction of fats, a sub-committee was formed with Professor B. N. Banerjee, of the Indian Institute of Science, as convener.

### Clay Studies in Australia

A modern laboratory for the study and analysis of clays has been established by a company in Melbourne, Australia. The company is engaged in the production of high-class electrical porcelains and radio ceramics, using steatite and zirconium silicates.

### Indian Tung Oil?

Tung oil, the ingredient for paints and varnishes, coming principally from China, has been the subject of research at the Forest Research Institute, Dehra Dun, India, and the results are incorporated in a pamphlet just published. Experiments at the institute show that the tung tree has a wide range which renders its propagation in many localities in India possible.

### Uranium Deposits in South Australia

Occurrences of uranium found in the Adelaide hills were disclosed by Mr. Playford, the Premier, last week when he announced that the State Government was sending the director of mines, Mr. S. B. Dickinson, to visit the U.S.A., Canada and Great Britain. Mr. Dickinson will study developments in uranium mining so that the commercial value of the South Australian deposits can be assessed and will discuss the exploitation of the uranium field at Radium Hill.

### Canadian Nylon Advance

Plans for the construction at Kingston, Ontario, of a plant to manufacture the base material for nylon, hitherto imported from the United States, are announced by Canadian Industries, Ltd. The new plant, adjacent to C.I.L.'s nylon plant, will cost about $500,000 and is expected to operate early in the summer of 1951. Basically it will combine the chemical solutions used to make nylon and its entire output will be used for the manufacture of yarn and staple fibre in the C.I.L. plant.

### Promising Results With French Pitchblende

Results of work at the pitchblende mine at La Crouzille (Haute Vienne) are reported by Professor Roubault, director of research at the Atomic Power Commissariat, to have been very satisfactory. The main characteristic of this seam is that the pitchblende is visible and can be sorted on the spot instead of being brushed, washed and sorted like the radioactive ore at Puy-de-Dome. Other soundings are being made over a 15 to 20 hectare area and some have reached a depth of 350 metres.

# · PERSONAL ·

POWER Jets (Research and Development), Ltd., announces that it has secured the collaboration, as consulting engineer, of MR. GEORGE JENDRASSIK, international authority on gas turbine and diesel engines. Mr. Jendrassik, who was born in Hungary, began work on gas turbine engines in 1935 and, just before the war, produced the world's first workable small gas turbine engine. It developed 100 h.p. He is a member of the Institution of Mechanical Engineers and has been on the board of Metropolitan Railcars, Ltd., since 1948.

Three Wellcome Pharmaceutical Research Fellowships of £350 each for one year have been awarded by the adjudicating committee of the Pharmaceutical Society to MISS M. DAWSON, Airdrie; MR. J. R. HODGES, Eastcote; and MR. G. P. LEWIS, Cardiff. Miss Dawson will do research work at the School of Pharmacy, Royal Technical College, Glasgow, of which she is one of the staff, on the properties of pyrogenic substances; Mr. Hodges at the School of Pharmacy, University of London, in pharmacology; and Mr. Lewis at the Welsh National School of Medicine, into the properties of a group of newly synthesised anti-histamine compounds.

Long service awards of clocks and wristlet and pocket watches have just been made to 109 employees at the Castner-Kellner works, Weston Point, Widnes, of I.C.I., Ltd. The presentations were made by MR. F. HOLT, technical managing director of the general chemicals division. Fifty-six of the recipients have completed 20 years and one, MR. J. WHITTLE, who is to retire this year, 51 years. Awards for long service have also been made at the I.C.I. Randle Works, Runcorn, to MR. R. P. LITTLER and MR. P. WOODWARD, each with 40 years' service, and MR. G. PALMER and MISS MARSH, each with 20 years' service.

A gold watch has been presented to MR. F. HANDFORD, manager of the Newcastle and Middlesbrough shipping offices of I.C.I., Ltd., in recognition of his service with the firm during more than 30 years.

MR. ALFRED WATTS, Collier Row, Romford, Essex, has completed 50 years' service with Howards & Sons, Ltd., the Ilford chemical manufacturers.

MR. H. YEOMAN, sales manager of the Clayton Aniline Co., Ltd., Manchester, has been appointed commercial manager, and MR. G. H. CARNALL deputy commercial manager. Mr. Carnall was formerly assistant secretary of the company.

MR. LEWIS G. WHYTE has resigned from the board of Petrochemicals, Ltd.

## OBITUARY

The death has occurred, at the age of 69, of MR. E. T. NEATHERCOAT, chairman and managing director of Savory & Moore, Ltd., and associated companies and formerly president of the Pharmaceutical Society of Great Britain. He became a student at Bloomsbury Square in 1900 and won the Society's silver medal for pharmacy and the bronze medal for practical chemistry in 1901/1902. He was elected to the society's council in 1909, only seven years after qualifying as a pharmaceutical chemist; he was on the council continuously for 30 years. He was vice-president from 1914-1919 and president from 1920-1924. Mr. Neathercoat was also a past chairman of the Pharmacy Board of Examiners, and it was during his term as president of the society—specifically in 1922—that the branch organisation as at present known was started. He was one of the three pharmacists who served on the departmental committee on the Pharmacy and Poisons Act and was also a member of the Poisons Board and of the society's statutory committee.

The British Coal Research Association has announced with deep regret the death, on July 29, of DR. D. H. BANGHAM, director of its research laboratories. He had been in failing health for some time. A note from the association recalls that Dr. Bangham was a fine scientist and a loyal colleague wholeheartedly devoted to his work and the interests of the association.

The death has taken place of CAPT. A. D. R. ALDRED, managing director of Shirley Aldred and Co., Ltd., wood distillers, Oakwood Chemical Works, Worksop, Notts. He had been associated with the firm since 1906, and during the first world war he took a leading part in the country's production of acetones. He was chairman and secretary of the National Association of Charcoal Manufacturers.

# HOME

### One Per Cent Tolerance for Mineral Oil

The Ministry of Food has amended the Mineral Oil in Food Order, 1949, to permit the use of prunes, currants, sultanas and raisins containing not more than 1 per cent of mineral oil and of foods in which such fruit forms a part.

### Derationing of Soap

Following the announcement that soap rationing will end on September 10, a general licence under the Soap (Licensing of Manufacturers and Rationing) Order, 1950, has been issued by the Minister of Food. This will enable wholesalers and retailers to obtain additional quantities of soap, without the surrender of ration documents, so that stocks may be built up to meet the anticipated demands when rationing ends.

### Glass Industrial Plant at Helsinki

Industrial plant in glass will be displayed by Quickfit and Quartz, Ltd., at the 7th Scandinavian Chemists's Congress, to be held at Helsinki from August 21-25 inclusive. The congress, which is expected to be attended by leading experts in the chemical industries from Denmark, Norway, Sweden and Finland, is to be addressed on the subject of glass chemical plant by Mr. B. H. Turpin, director and manager of the London company.

### Criticism of Alkali Works

Chemicals dispersed by the wind from the I.C.I. works at Northwich were harming trees, shrubs and grass in Verdin Park, Mr. T. Garwood (Parks Superintendent) told Northwich Urban Council Parks Committee on July 25. They adopted his report. The laundry of people in Winnington was also affected, said Councillor Mrs. E. Bowden. Councillor W. H. Young doubted the accuracy of the complaint, saying shrubs and flowers at the I.C.I. works were healthy.

### Additions to the Poisons List

The Home Office has announced changes in the Poisons List which come into operation on September 1. Among a substantial list of substances added under the first schedule are certain anti-histamine substances and their salts. These now come under Group 2 of the schedule and are exempted from the provisions of the Pharmacy and Poisons Act when in the form of preparations for external application only.

### Dearer Glycerin

The price of glycerin (in large tonnage lots) was raised on August 1 by £40 a ton, to £165 6s. a ton. This is the highest figure ever reached in Britain for glycerin, and was to bring the home price more in line with that of manufacturers abroad. The former peak price in the U.K. was £140 a ton reached in 1920. It is not expected that the end of soap rationing will affect available supplies of glycerin.

### Unrestricted Imports

The following are among the items which, from August 1, have been added to the list of goods which may be freely imported from the " permitted " countries on the usual list to which the policy for the liberalisation of trade is applied: Tea seed oil; compressed gases; painters' materials, specifically distempers (whether dry or not), dry earth colours, pigments and extenders (whether dry or with oil or with other medium, including metallic powders—except aluminium powder—but not including lithopone; tin oxide).

### Doctors Visit Research Establishment

On July 20 a large party of doctors attending the British Medical Association conference at Liverpool, went to the Evans Biological Institute at Runcorn, where a scientific conversazione was held. A number of doctors also visited the Speke headquarters of the company during the week. The Evans Biological Institute is engaged in research on sera and the preparation and standardisation of sera and vaccines, liver extracts, heparin, hyaluronidase, cytochrome C and other biological products.

### High Exports to North America

The provisional value of United Kingdom exports in June to the United States was £8.0 million and to Canada £9.3 million. In terms of United States dollars these totals were $22.4 million and $26.0 million respectively, compared with $23.0 million and $34.7 million in May and $15.6 million and $25.0 million in April. The dollar value of exports to the U.S.A. and Canada together for the second quarter of 1950 thus represented a monthly rate of $48.9 million, compared with $42.8 million in the previous quarter. It was the highest quarterly dollar equivalent for exports to North America, except that for the fourth quarter of 1948.

# The Stock and Chemical Markets

RECENT business remained restricted and price movements were slightly against holders in most sections, sentiment reflecting fears that rearmament connotes higher taxation. Only steel and rearmament shares have shown gains in prices on balance for the week.

Imperial Chemical remained fairly steady at 40s. 7½d. Lever & Unilever eased to 38s. 6d. although no reference was made at the meeting to new capital requirements. The City belief remains that before long more money will be required, particularly as the imminent end of soap rationing means that increased stocks of materials will have to be financed. Laporte Chemicals 5s. units were 10s. 3d., Boake Roberts strengthened to 28s. on the excellent financial results and Albright & Wilson were firm at 29s. 6d. awaiting news of the company's new issue plans. Amber Chemical were 3s., F. W. Berk 2s. 6d. shares 10s. 3d., Bowman Chemical 5s. 3d., Brotherton 10s., Monsanto 48s. 9d., and W. J. Bush ordinary were 79s. 4½d. Burt Boulton & Haywood have changed hands at 26s. 1½d. British Glues & Chemicals 4s. shares have held their rise to 23s. on the excellent results and share bonus proposals. Lawes Chemical were quoted at 10s. 3d. and Cellon changed hands at 18s. Fisons were steady at 25s. 6d. and Borax Consolidated kept at 54s. 6d., but plastic companies' shares again tended to fluctuate, with De La Rue around 22s. 9d., British Xylonite 72s. 6d., Erinoid 5s. shares 8s. 9d., and British Industrial Plastics 2s. shares 5s. 6d. The 4s. units of the Distillers Co. remained active around 18s. on further consideration of the past year's results and 20 per cent dividend. Griffiths Hughes strengthened to 21s. 10½d. on the full results and chairman's annual statement and Boots Drug were firm at 47s. 3d. Turner & Newall receded to 79s. 6d. and United Molasses at 41s. 9d. were uncertain, but United Glass Bottle kept at 75s. Triplex Glass at 21s. 9d. tended to ease on the view now prevalent that it is doubtful whether the dividend will be increased at this stage, and is more likely again to be limited to 15 per cent.

Iron and steels have been prominent with other companies which should benefit from rearmament work. United Steel moved up to 28s., Dorman Long to 31s., Hadfields to 28s. 3d., South Durhams to 31s. 9d., Colvilles to 35s. 6d., and John Summers to 30s. 9d. Guest Keen were 45s. 10½d., Ruston & Hornsby 30s. 3d. and Staveley steady at 78s. 6d.

Glaxo Laboratories were 46s. 4½d., Sangers 22s., Beechams deferred 12s. 9d., Associated Cement came back to 83s. 3d., British Plaster Board 5s. units to 14s. 7½d. and Wall Paper Manufacturers deferred to 48s. 3d. Oils have been uncertain, although they were inclined to strengthen after an earlier further small decline. Anglo-Iranian were slightly under £5⅜, Shell 62s. 6d., Burmah Oil 55s. 7½d. and Trinidad Leaseholds 5s. shares 23s. 6d.

## Market Reports

THE approach of the holiday season has had its influence on the markets and spot transactions have been rather less in volume. Interest in new contract business, on the other hand, has been fully maintained and the volume of inquiry for home and export account appears greater than usual. The price position is generally firm, apart from the changes recorded for glycerin, now 168s. dearer per cwt. for 1 ton lots, and for antimony oxide, which has been reduced by £7 10s. per ton. Caustic soda and soda ash are in active request and there is a ready outlet for sodium sulphide and sodium bicarbonate. Offers of the potash chemicals are quickly absorbed and other items in good call include formaldehyde, hydrogen peroxide and the barium compounds. A steady trade is reported for most of the coal tar products and xylol is firm on a good demand.

MANCHESTER.—Traders in heavy chemicals again report some interference with new business as a result of holiday stoppages and with the movement of supplies against existing orders. However, trade as a whole is about up to the level of previous years. A moderate amount of overseas business is reported. Prices generally are on a strong basis. Trade in fertilisers has been fairly satisfactory, although seasonally rather quiet. Light tar products continue to meet a steady demand.

GLASGOW.—Renewed activity has been evident in the Scottish heavy chemical market. The export market has also shown signs of revival. There is a distinct tendency throughout for prices to harden.

# Law and Company News

## Commercial Intelligence

**The following are taken from the printed reports, but we cannot be responsible for errors that may occur.**

### Mortgages and Charges

**(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)**

DEMA GLASS, LTD. (formerly DEMA SUPPLIES, LTD., London, N.W. (M., 5/8/50.) July 3, £16,000 first mort., to Scottish Temperance & General Assce. Co., Ltd. & £5250 second mort., to Wimbledon Laundry, Ltd.; charged on land & buildings, Cranbrook Road, Wimbledon. *—. Jan. 13, 1949.

NORTH BRITISH ALUMINIUM CO., LTD., Lonon, E.C. (M., 5/8/50.) June 26, disposition granted in implement of a trust deed dated July 30, 1947, & supplemental deed dated Nov. 10, 1948, securing deb. stock of British Aluminium Co., Ltd.; charged on specified portions of the lands of Glen Nevis, Kilmallie. *—. May 16, 1950.

RAINBOW FIREWORK CO., LTD., London, W. (M., 5/8/50.) June 30, £2500 debs.; general charge.

TRENT VALLEY GLASSWORKS, LTD., London, W.C. (M., 5/8/50.) June 30, deb., to Martins Bank, Ltd. securing all moneys due or to become due to the bank; general charge. *—. Oct. 19, 1949.

### Receivership

JOHN TYE & SON, LTD., manufacturing chemists, etc., 457 Caledonian Road, N.7. (R., 5/8/50). Mr. Geo. Hay, 50 Pall Mall, S.W.1, was appointed receiver on July 13, 1950, under powers contained in debenture dated July 24, 1947.

## Company News

### Benn Brothers, Ltd.

The directors of Benn Brothers, Ltd., recommend the payment of the following final dividends, less tax, for the year ended June 30, 1950: 3 per cent on preference shares, making 6 per cent for the year; 20 per cent on ordinary shares (25 per cent for the year—same); 5s. per share on the deferred shares (same).

### Canadian Group's Loss

The annual report of the Canadian group, Commercial Alcohols, Ltd., and its subsidiary, Eastern Distillers, Ltd., shows net loss of $300,630 for the year ended March 31, 1950. There was a net loss of $121,904 in the preceding year. A profit and loss deficit of $204,421 is carried forward, against a surplus of $96,208 at the close of preceding year. The report, signed by C. G. Kertland, president, states that of the net loss a write-down of the value of inventories accounted for approximately $200,000. Mr. Kertland states that the net loss reflects low alcohol production at Gatineau, Quebec, low prices for certain industrial grades of alcohol and generally unsatisfactory conditions under which operations were carried on.

## New Registrations

### Arborn Chemical Laboratories, Ltd.

Private company. (484,777). Capital £1000. Manufacturers, processors and distributors of chemicals and chemical compounds, etc. Directors: A. B. Armitage, A. J. Osborn, N. B. W. Cooper and F. D. Mills. Reg. office: High Holborn House, 52/4 High Holborn, W.C.1.

### Lurie Laboratories, Ltd.

Private company. (484,811). Capital £500. To acquire from David Lurie, of Paris, and utilise his inventions relating to the production and treatment of fireproof materials, etc. Directors: D. Lurie, 65 Rue de Lagney, Paris, 20; Jindrich Ost, 981 Finchley Road, N.W.11.

### Increases of Capital

The following increases in registered capital have been announced: Croda, Ltd., from £25,000 to £40,000; Jensen & Nicholson from £700,000 to £900,000; Ciba Laboratories, Ltd., from £150,000 to £380,000; Grindley & Co., Ltd., from £40,000 to £55,000; Laboratories for Applied Biology, Ltd., from £1500 to £5500; Union Oxide & Chemical Co., Ltd., from £20,000 to £30,000; Airfoam Fire Protection, Ltd., from £11,100 to £50,100; Tretol, Ltd., from £10,000 to £20,000.

# Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

## Complete Specifications Accepted

Refining of metals and alloys.—J. Miles & Partners (London), Ltd., J. Miles, G. L. Thomas, and A. G. E. Robiette. Aug. 23 1946. 642,084.

Method of removing carbon from steel.—Chromium Mining & Smelting Corporation. May 21 1946. 642,086.

Process for preparing pure crystalline salts of penicillin, and the pure crystalline salts of penicillin resulting therefrom.—Commercial Solvents Corporation. Aug. 23 1946. 642,369.

Process for the production of substituted diphenylamine 2-monocarboxylic acids.—Ward, Blenkinsop & Co., Ltd., A. A. Goldberg, and H. S. Turner. Aug. 22 1947. 642,091.

Manufacture of therapeutically active sulphur compounds.—Ward, Blenkinsop & Co., Ltd., A. A. Goldberg, and H. S. Turner. Aug. 22 1947. 642,092.

Method of facilitating chemical processes by means of electrical discharges.—J. E. Nyrop. Nov. 12 1946. 642,335.

Fibre board and the like containing resins.—W. W. Triggs. Nov. 12 1946. 642,245.

Process for the treatment of solid particles in fluidised condition.—J. C. Arnold. (Standard Oil Development Co.). Feb. 28 1947. 642,115.

Mothproofing preparations.—Merck & Co., Inc. March 7 1947. 642,248.

Antibiotic substances.—E. R. Squibb & Sons. April 2 1947. 642,249.

Absorption media for carbon monoxide and the treatment of gases containing carbon monoxide.—Sulzer Frères Soc. Anon. June 10 1947. 642,318.

Methods of decomposition of waste sulphuric acid to sulphur dioxide.—United Chemical & Metallurgical Works, National Corporation. June 25 1947. 642,128.

Manufacture of quinazoline derivatives.—Ciba, Ltd. July 2 1947. 642,129.

Preparation of quinazolones.—General Aniline & Film Corporation. July 28 1947. 642,134.

Reaction of vinyl ethers with thiols.—General Aniline & Film Corporation. Aug. 8 1947. 642,253.

Catalytic cracking of heavy hydrocarbons.—Anglo-Iranian Oil Co., Ltd., and G. I. Jenkins. July 23 1948. 642,325.

Production of organo-silicon compounds.—Monsanto Chemical Co. Aug. 14 1947. 642,139.

Methods of preparing resinous compositions from cyclo-pentadiene and liquid coating compositions containing same.—Velsicol Corporation. Oct. 10 1947. 642,331.

Apparatus for assessing the amount of a gas of relatively high magnetic susceptibility contained in a mixture of gases.—G. Kent, Ltd., and R. S. Medlock. Oct. 7 1948. 642,156.

Preparation of diphenyl ethers.—Glaxo Laboratories, Ltd. Oct. 5 1948. 642,159.

Moulding compositions containing aminoresins.—Hornflowa, Ltd., F. M. Herzberg, R. Neiger, and W. H. Roscoe. Dec. 12 1947. 642,258.

Process for the manufacture of fertilisers.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny & Cirey. Dec. 29, 1947. 642,177.

Silica-extended tin oxide and method of preparing the same.—Jan. 6 1948. 642,179.

Process for preparing organo-silicon fluorides.—F. J. Sowa. Feb. 4 1948. 642,189.

Process for the manufacture of heterocyclic bases.—Roche Products, Ltd. Feb. 27 1948. 642,346.

Manufacture of pigments.—I.C.I., Ltd., and J. Glassman. Feb. 4 1949. 642,204.

Resinous compositions.—Westinghouse Electric International Co. March 16 1948. 642,350.

Packing materials comprising fluorine-containing polymers.—E. I. Du Pont de Nemours & Co. March 18 1948. 642,269.

Addition compounds of organic amides.—I.C.I., Ltd., S. Coffey, G. W. Driver, D. A. W. Fairweather, and F Irving. March 23 1949. 642,206.

Processes of preparing cycloalkyl ethers of *p*-hydroxybenzoic compounds and the compounds resulting from said processes.—E. Lilly & Co. April 28 1948. 642,357.

Process for the preparation of 2, 5-diacyloxy-2, 5-dihydrofurans.—Kemisk Vaerk Koge A/K. April 29 1948. 642,277.

Pesticidal compositions.—B. F. Goodrich Co. Aug. 22 1946. 642,534.

Stabilised halogenated aromatic compounds and articles including such stabilised compounds.—Monsanto Chemical Co. March 31 1947. 642,406.

Preparation of guanamines.—American Cyanamid Co. May 6 1947. 642,409.

Glass-to-metal seals and alloys therefor.—British Thomson-Houston Co., Ltd., J. E. Stanworth and G. D. Redston. Dec. 9 1948. 642,668.

# CLASSIFIED ADVERTISEMENTS

## SITUATIONS VACANT

A VACANCY exists on the senior staff of a Lancashire chemical company for a **RESEARCH CHEMIST**—age 25/35—to control several research groups. Good qualifications, industrial research experience, and the ability to control scientific staff are essential. The commencing salary will be £850 per annum. Reply to Box No. C.A. 2938, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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**OIL REFINERY CONTRACTORS** handling large contracts for refinery plant, require **CONTRACTS ENGINEERS** in their London office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience of refining industry or heavy engineering including a wide knowledge of pumping, heat-exchange equipment and instrumentation, and the appointment offers excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience to **FOSTER WHEELER LTD., 3 Ixworth Place, London, S.W.3.**

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Applications should be addressed to **Lever Brothers & Unilever Limited, Personnel Division (FMD), Unilever House, Blackfriars, London, E.C.4.**

THE CIVIL SERVICE COMMISSIONERS invite applications for six permanent appointments of **CHEMIST I** and twelve for **CHEMIST II** in the Ministry of Supply.

Candidates must be at least 30 on 1st January, 1950. Candidates must have obtained (*a*) a University Honours Degree in Metallurgy, Engineering, Chemistry, Physics or Chemical Engineering; or (*b*) have Associateship of the Royal Institute of Chemistry, the Institution of Metallurgists, or the Institute of Physics, or (*c*) have Corporate Membership of the Institution of Chemical Engineers. Candidates qualified under (*a*) or (*b*) must also have had at least three years' approved experience in a factory or industrial laboratory. Exceptionally, alternative evidence of very high professional attainments may be accepted.

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A **FILTER PRESS,** 31½ in. square, fitted with 42 C.I. plates, centre fed.

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No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

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No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

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These three "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

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